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Radiographic Diagnosis of Prolapsed Redundant Gastric Mucosa into the Duodenum, with Remarks on the Clinical Significance and Treatment[1]

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PROLAPSES OF redundant or hypertrophied gastric mucosa into the duodenum occur frequently enough that they should be recognized and their clinical significance properly evaluated. Experience in the past few years indicates that the filling defects thus produced occasionally are misinterpreted and confused with those due to duodenal ulcers, duodenitis, or similar disorders. Furthermore, when such prolapses are present, the tendency of some physicians has been to regard the condition as of no clinical significance.

In the U. S. Navy, the diagnosis of duodenal ulcer is a serious matter, as it involves decisions regarding promotion, type of duty, or even separation from the service. On the other hand, a man incapacitated by gastric distress from a prolapse of the gastric mucosa, with or without the complications of hemorrhage or obstruction, can be rehabilitated by surgical measures and returned to active duty.

INCIDENCE

In eleven months there were admitted to a large Naval Hospital over 19,000 patients. On them were made 1,346 successive roentgen examinations of the upper gastro-intestinal tract (Table I): 13 patients were found to have gastric ulcers, 325 patients duodenal ulcers, 17 patients duodenitis, and 14 patients prolapses of the gastric mucosa. No cases of gastric cancer were discovered. Thus, in this group of young and adult men, prolapse of the gastric mucosa occurred as often as gastric ulcer. It should be pointed out that the roentgen diagnosis of duodenal ulcer was not neglected, since it formed 24 per cent of the diagnoses. This high figure should not be construed as representing the incidence among naval personnel, as all patients in whom a peptic ulcer is found or suspected at the medical dispensaries in a large district are sent to this hospital for evaluation and disposition.

TABLE I: INCIDENCE OF GASTRIC AND DUODENAL LESIONS, (OCTOBER 1943 TO SEPTEMBER 1944)

Hospital admissions	19,228	
Upper gastro-intestinal series	1,346	
Gastric ulcers	13	(0.96%)
Duodenal ulcers	325	(24.1%)
Duodenitis	17	(1.3%)
Prolapse of gastric mucosa	14	(1.04%)
Gastric tumors	0	

[1] The opinions or assertions contained herein are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

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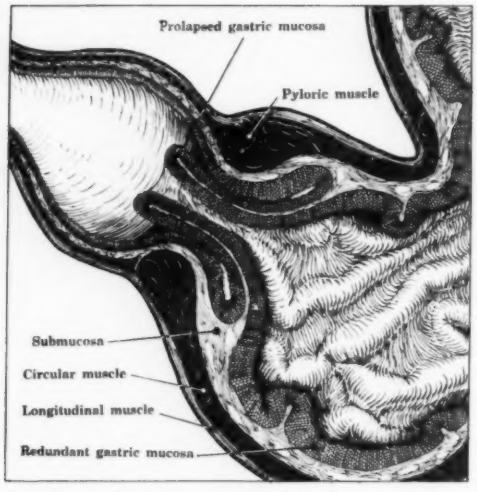

Fig. 1. Diagram of antrum of stomach and duodenum illustrating a large prolapse of the gastric mucosa.

The great proportion of the muscle fibers in the walls of the stomach end in the pyloric muscle. With this construction they are firmly anchored and do not prolapse. This permits large hypertrophied and redundant loose folds of gastric mucosa to invaginate through the pylorus into the duodenum. From the duodenal side the prolapsed gastric mucosa appears as a loose protruding "collar." Only the mucosa and submucosa are in the prolapsed folds of tissue.

This diagram also explains the production of the characteristic "cauliflower" negative filling defect in the base of the duodenal bulb. The barium fills the bulb completely except for the space occupied by the prolapsed gastric mucosa, which gives the negative shadow. The filling defects necessarily vary in shape, size, and extent during any one examination, as the folds of prolapsed mucosa are soft and flexible, and at times are partially or completely reduced and remain within the stomach. Drawing by Louise Garden.

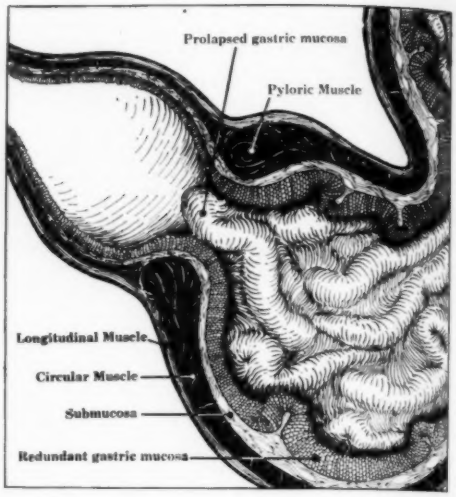

Fig. 2. Small prolapse of the gastric mucosa. Small prolapses are more common and are usually of less clinical significance.

In the early stages of development a small fold of gastric mucosa may protrude into the base of the duodenal bulb to give a small negative shadow. These defects are easily recognized and differentiated from duodenal ulcers, as they occur opposite the pyloric opening. Compare with Figs. 15, 16, and 17. Drawing by Louise Garden.

The 1.04 per cent incidence of gastric prolapse is higher than that given by Rees (19), whose group found this disorder 4 times in 3,000 x-ray examinations, or at another hospital, where it was observed twice in 2,550 x-ray examinations. Melamed and Hiller (14) found only 19 proved cases in the literature, which with their one case made a total of 20 in 1943. Archer (1) states that prolapsing gastric mucosa is not rare, but gives no figures. In my experience, prolapses of the gastric mucosa occur more frequently than is generally recognized. They are overlooked because: first, the examiner is not thinking about them; second, the filling defect produced by the prolapse is confused with that due to a duodenal ulcer or a duodenitis; third, when recognized, they are sometimes passed over and not mentioned.

It is our contention that the roentgenologist should make a positive effort to find this disorder, to distinguish it from duodenal ulcer or other duodenal filling defects, and to report its occurrence to the referring physician. At the same time, it should be made clear that not every patient with a prolapse of the gastric mucosa has a serious disorder or that surgical measures are invariably indicated.

The age incidence is not striking. The largest number of cases in our series occurred in the fourth decade.

20–29 years	4 cases
30–39 years	7 cases
40–49 years	3 cases

ETIOLOGY AND PATHOLOGY

The underlying etiologic factor, or factors, leading to a prolapse of the gastric mucosa is not known. Several theories

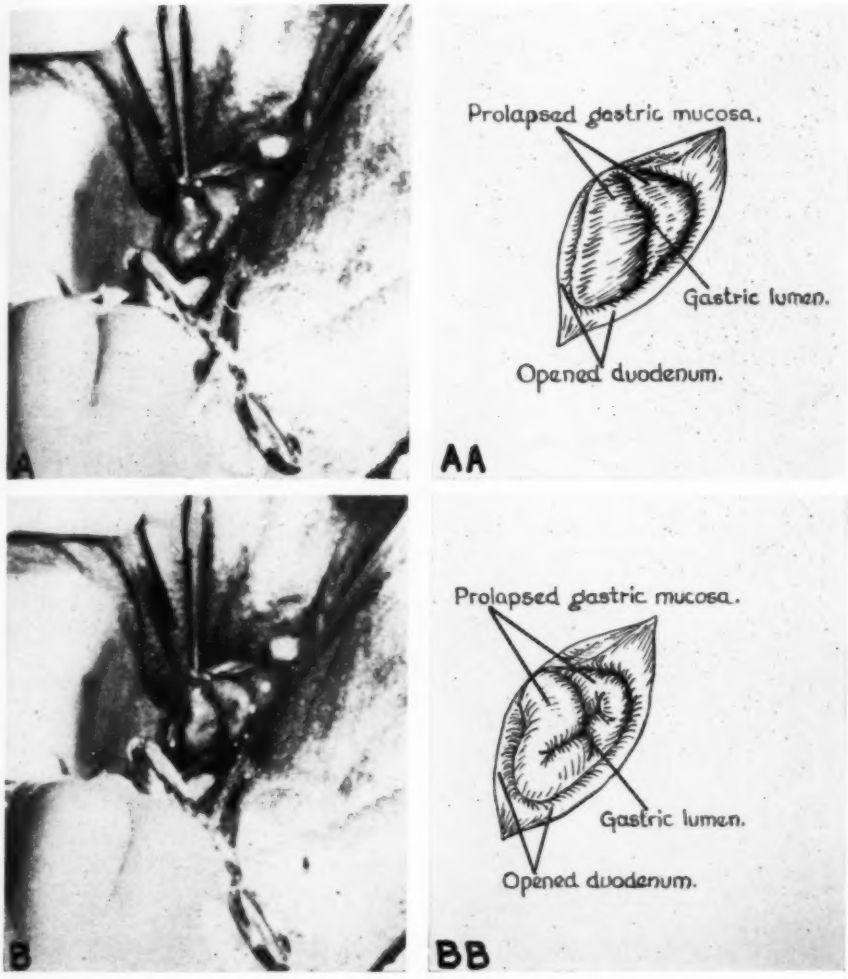

Fig. 3. Photographs made at operation after the duodenal bulb had been incised and opened demonstrate the prolapsed "collar" of gastric mucosa projecting well into the duodenum. Case IV.
A. The prolapse "collar" is spread out and shows the canal leading back into the stomach.
B. The redundant "collar" of prolapsed gastric mucosa could be manually reduced but would slowly protrude again in loose folds, obliterating the canal leading into the stomach.
AA and BB are tracings of the adjacent photographs.

have been offered. Eliason and Wright (8) believe that a low-grade inflammation of the mucosa produces a local hypertrophy. The hypertrophied folds are enlarged mechanically by the contractions of the stomach and the pressure of gastric contents. As a result, they are lengthened and "pushed along" toward the pylorus. When sufficiently long, they are swept into the duodenum by a peristaltic wave.

Rees (19) proposes another mechanism, in which a narrowing of the pyloric lumen precedes the actual change in the gastric mucosa. The narrowing is followed by hyperperistalsis of the stomach in an effort to force its contents through the smaller opening. This action loosens the attachment of the mucous membrane to the muscularis. When the mucosa is so mobilized, it is subjected to trauma, which

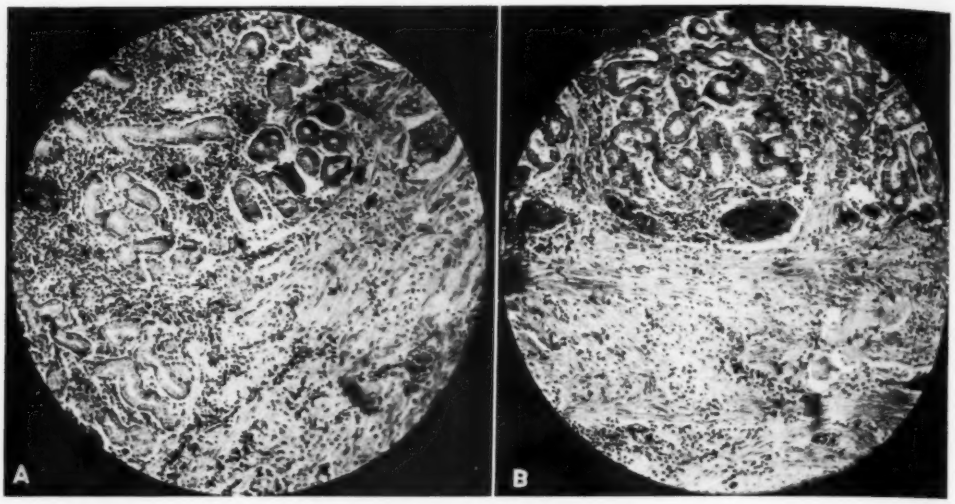

Fig. 4. Photomicrographs of resected portions of prolapsed gastric mucosa do not reveal evidence of a gastritis or of cellular infiltrations other than a very slight increase in the number of lymphocytes, plasma cells, and eosinophils in the mucosa and submucosa. A. Case II (see Fig. 8). B. Case III (see Fig. 9).

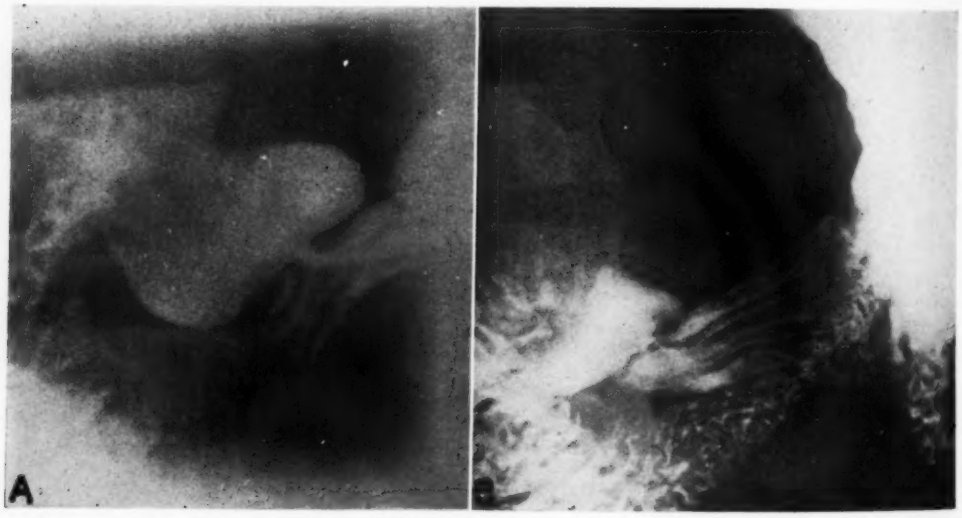

Fig. 5. The motility of the mucosa is illustrated in these films of the antrum of a normal stomach in which the pattern of the rugae is altered during different phases of peristalsis, as described by Golden. Both films are of the same patient and were made in the erect position within a few minutes of each other.
A. At this phase in peristalsis the rugae in the prepyloric portion of the stomach assume a transverse position.
B. During antral systole the rugae are stretched and run in horizontal rows at right angles to their previous position.

leads to hypertrophy, prolapse, and later polypoid degeneration.

Neither of these theories is fully supported by our studies. In the initial three patients, and in the subsequent two patients that required operation, there was no roentgenologic, gastroscopic, operative, or pathologic (gross or microscopic) evidence of a gastritis as suggested by Eliason's group. By the same criteria, there

was no evidence of a narrowing of the pyloric canal. The pyloric muscle was not constricted or hypertrophied.

At operation, the prolapsed portion of the gastric mucosa appeared as a loose "collar" of redundant hypertrophied gastric mucosa that had invaginated into the duodenum. Figures 1 and 2 are diagrammatic drawings of a large and a small prolapse of redundant gastric mucosa. The photographs and simplified tracings in Figure 3 demonstrate the prolapsed mucosa as seen at operation in Case 4. In the cases submitted to operation, the prolapsed portion of the gastric mucosa was not a finger-like projection of a single mucosal fold, but a rounded "collar." It could be forced back into the stomach but would protrude again as a long "rosette." The prolapsed folds appeared the same as normal mucosa to the unaided eye. They were soft and pliable—not fixed, thick, or indurated—and were in no way different from normal gastric mucosa other than being large and excessively mobile on the muscularis. No areas of erosion or ulceration were found, but these patients had been on a Sippy regime for some weeks prior to operation. The prolapses of the gastric mucosa were similar in the other four patients submitted to operation.

Microscopic examination of the resected gastric mucosa from the five patients operated on by Capt. Clyde Jensen (MC) U.S.N.R. revealed a slight increase in the lymphocytes, plasma cells, and eosinophils throughout the mucosa and submucosa, but not sufficient to warrant a diagnosis of gastritis (Fig. 4).

In an effort to correlate these findings and to explain the occurrence of prolapses of gastric mucosa, the problem was reviewed, and from a study of the anatomy of the stomach walls and of the physiologic movements of the mucosa on the muscularis, it appears that prolapses result from an excessive and abnormal mobility of the pyloric mucosa on the muscularis.

To review the anatomy of the stomach briefly, Cunningham's (3) and Gray's (13) textbooks state that the longitudinal fibers

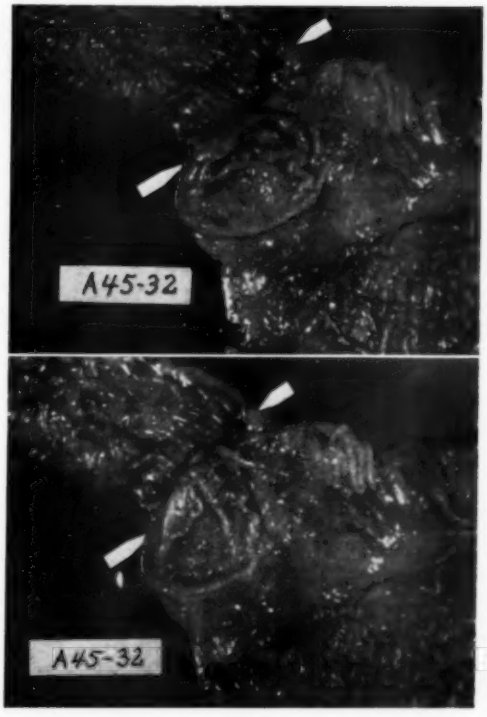

Fig. 6. An autopsy specimen of the antrum of a stomach in the prepyloric portion of which are large loose folds of mucosa or rugae. These were soft and flexible and could be moved manually over the muscularis for a considerable distance and easily pushed across the pylorus into the duodenum to simulate at least, if not actually produce, what we term a prolapse of the gastric mucosa. This specimen was obtained from a patient who died of severe cardiovascular disease and myocardial infarctions. Unfortunately, no roentgen examination of the stomach had been made.

A. The large folds of gastric mucosa arranged in the prepyloric area are all proximal to the pyloric sphincter, whose position is indicated by the white arrows.

B. The folds of prepyloric gastric mucosa were pushed across the pyloric sphincter and lie within the base of the duodenal bulb as is seen in prolapse of the gastric mucosa.

of the muscularis become much thicker and tougher and more closely united toward the pylorus. The more superficial fibers to a very slight degree pass onto the duodenum, but the deeper fibers dip into and interlace with the circular fibers of the pyloric sphincter. The circular layer of the muscularis increases in thickness at the pylorus and forms the bulk of the pyloric sphincter. These muscle fibers are sharply marked off from the circular fibers of the

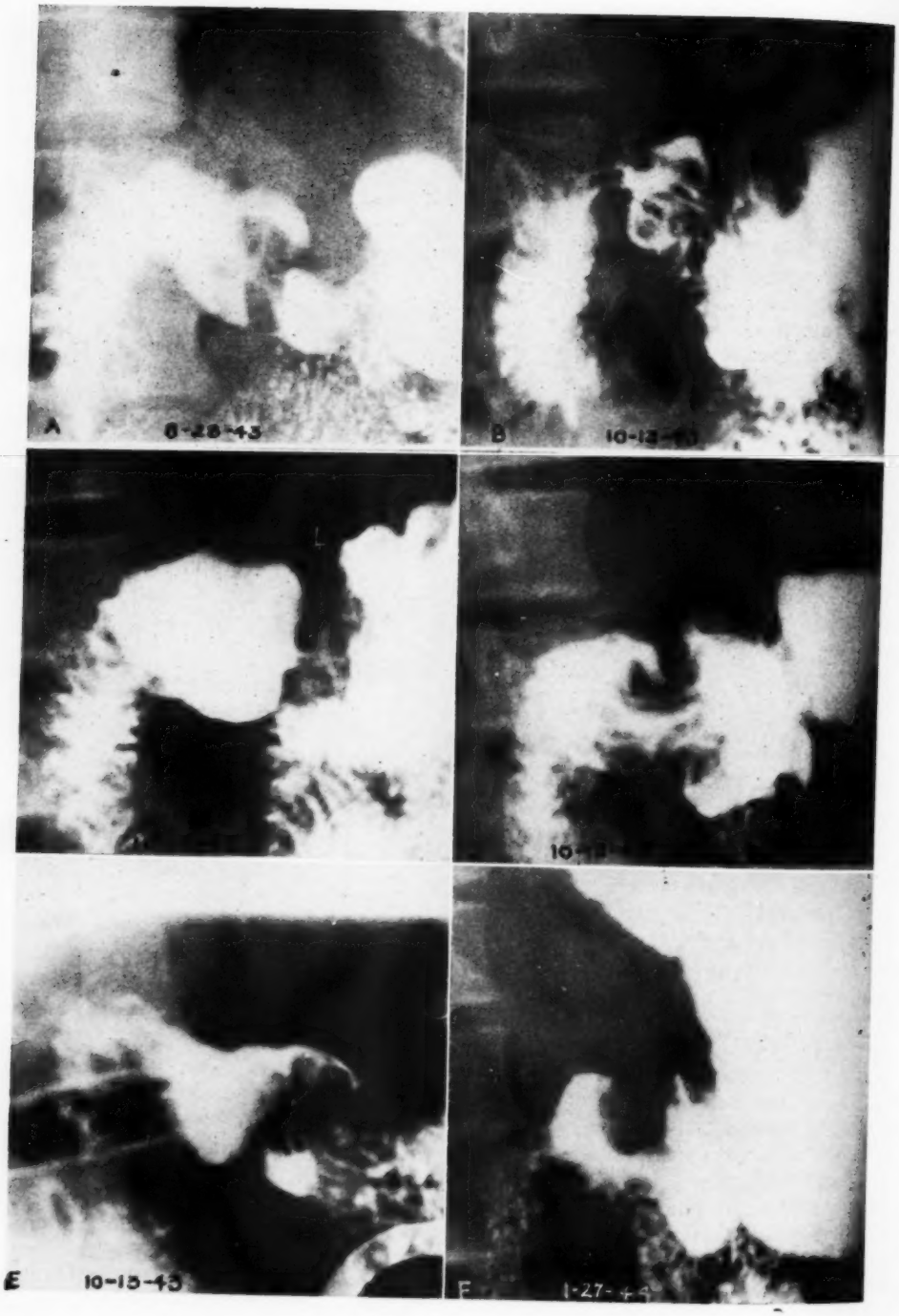

Fig. 7. Case 3

For description and case history, see page of opposite page

duodenum. Thus the fibers of the muscularis largely end in the pyloric sphincter, where they are firmly anchored and cannot prolapse (Figs. 1 and 2).

On the other hand, the mucosa is considerably thickened over the pyloric sphincter, where it forms a low fold, but continues into the duodenum without visible alteration or stronger connections with the underlying muscle. The mucosa and muscularis are not cemented together, but are connected by a soft, yielding submucosa composed of loose areolar tissue containing blood vessels, lymphatics, and nerves.

This construction of the stomach walls explains the limited mobility of the mucosa on the muscularis as found in all normal stomachs. The mobility is easily demonstrated in autopsy specimens by sliding the mucosa on the muscularis, and in living tissue by sliding the mucosa over the edge of the muscularis when the stomach is cut across at operation. Normally the extent of this movement is not sufficient to permit a prolapse of the mucosa through the sphincter into the duodenum.

Furthermore, the mobility of the mucosa is not only passive but, according to Forssell (9), it possesses an active movement, as folds may vary in size, shape, and position independently of the contraction of the muscularis. A similar movement was observed by Golden (10), who noticed that during antral systole folds of mucosa running transversely across the antrum were changed to run in neat horizontal rows parallel to the long axis of the stomach. To explain this change, he believed that it was necessary for the mucosa to move cephalad and become stretched on the muscularis. Otherwise, as the antrum closes off, the crisscross folds would be exaggerated, pushed downward, and jammed toward the pylorus. In support of his view, Golden cites Schindler's (21) gastroscopic observations that, during antral peristalsis, the antrum is shortened and the mucosa is arranged in radial folds. Golden mentions the possibility that the failure of this stretching mechanism may account for the herniation of prepyloric mucosal folds. The movement described

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Fig. 7. A and B. Typical roentgenograms of marked prolapse of the gastric mucosa with "cauliflower-like" negative defect in the base of the duodenal bulb. The bulb has a perfect contour in C. Note the variation in the size and extent of the prolapsed gastric mucosa in A to E. The postoperative appearance, after resection and a pyloroplasty, is recorded on film F.

Case History: A 25-year-old sailor complained of intermittent attacks of epigastric pain for the past eighteen months. The pain came on about one hour after meals and was relieved by food and milk. He had been on combat duty and was wounded in the right forearm two months prior to admission. He was seen at a medical dispensary and sent to the hospital for study.

The first x-ray examination of the stomach was made on Jan. 8, 1943, and the report was that the duodenal bulb was deformed by an ulcer. The patient was placed on a Sippy regime which included seventy days of hospitalization. He showed moderate improvement and returned to duty. At the end of one week he re-entered the hospital because of persistent "gas" and epigastric distress. Following a second sixty-three-day ulcer treatment he improved but did not become asymptomatic.

On June 5, 1943, the patient returned to limited shore duty but after twenty-one days he was back in the hospital, complaining of almost continuous epigastric pain. The stools were negative for occult blood. Gastric analysis showed a peak of 11.2° of free HCl and a total acidity of 27.5° at one hour. A second x-ray examination of the stomach showed the duodenal bulb still deformed, but with less spasm and irritability. The Sippy treatment was continued for ninety days with little benefit. Because of persistent symptoms and the refractory response to medical treatment, an exploratory laparotomy was done on Sept. 15, 1943. The surgeon found the duodenal bulb normal. There was no induration, "stippling," or adhesions as evidence of a duodenal ulcer.

With this knowledge, the films were reviewed and it was apparent that the duodenal defect previously observed was due to a large prolapse of gastric mucosa. A third x-ray study of the stomach was done on Oct. 13, 1943, and confirmed the persistence of the prolapse.

A second operation was performed on Nov. 14, 1943. This time the bulb was opened and in its base a large "collar" of invaginated gastric mucosa was found. This was resected and the pylorus enlarged by a Finney pyloroplasty. No scars or ulcer defects were seen on the duodenal mucosa.

Following an uneventful convalescence, the patient was discharged to limited duty and has been able to do his job. He was last examined on Nov. 28, 1944, over one year after operation. At that time he was well, had gained 18 pounds in weight, and had been eating the regular Navy "chow." He has not been in a dispensary or hospital for treatment of any kind.

The case illustrates the persistence of symptoms and failure to respond satisfactorily to a carefully controlled ulcer regime which should make one suspicious of the diagnosis. Second, it demonstrates that the prolapsed gastric mucosa cannot be felt through the intact walls of the duodenum because the mucosa is not thickened, fixed, or indurated.

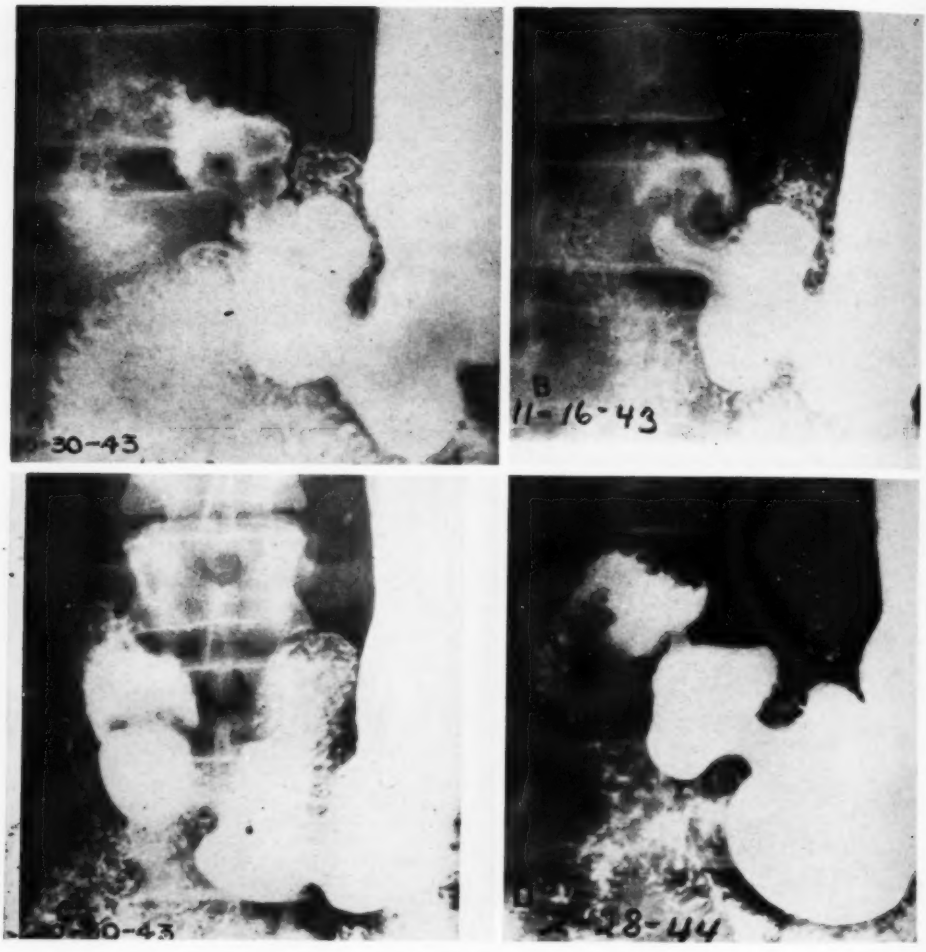

Fig. 8. Case II.

A and B. The prolapse of the gastric mucosa in this instance is more in the form of a large loose "collar" and produces what has been termed an "umbrella" type of defect in the base of the duodenum. This defect persists when the bulb is distended and can be seen through the overlying barium. D is the post-operative film, after resection of the prolapsed gastric mucosa and a pyloroplasty.

Case History: A 41-year-old chief yeoman entered the hospital on Oct. 27, 1943. In March 1941, he experienced attacks of epigastric pain before meals. They were relieved by food and occasionally by alkalies. X-ray examination of the stomach then revealed a defect that was interpreted as a duodenal ulcer and the patient was labeled with this diagnosis. A modified ulcer diet and regime made him comfortable for the next few years. In June 1941 he was retired to civilian life, but almost immediately he was recalled to active duty.

Until four to six months before admission he had been careful of his diet and got along fairly well. His work then became strenuous and required long hours. He neglected his diet, ate irregularly, and his symptoms were aggravated. The pain rarely woke him at night but was always present in the morning. He vomited occasionally. He had lost weight and was undernourished. The findings on physical examination were essentially normal and routine laboratory reports were all negative. The stools were twice positive for occult blood. On two occasions no free HCl was obtained, and the total acidity reached 13° in the fasting specimen, using histamine. Oral cholecystography demonstrated a normally functioning gall-bladder. A gastro-intestinal series on Oct. 30, 1943, revealed a large prolapse of redundant gastric mucosa into the duodenum. Repeat examinations, Nov. 16 and Dec. 18, showed the same findings.

The patient was placed under medical treatment on a Sippy regime, including bed rest, for seventy days, with some improvement, but not enough to return to duty.

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by him is illustrated in the films reproduced in Figure 5.

In the past twenty-one months, 126 stomachs were examined at autopsy for evidence of excessive mobility of the mucosa or a prolapse. In only one case (Fig. 6) was it possible to pull the gastric mucosa with surgical forceps through the pyloric sphincter into the duodenum to simulate a prolapse. In this instance, large redundant rugae were found in the prepyloric portion of the stomach. They were soft, flexible, and freely movable on the muscularis. These folds of gastric mucosa could be pushed across the pyloric ring into the duodenal bulb in a manner comparable to that seen in prolapses of the gastric mucosa at operation. The patient died from severe cardiovascular disease with myocardial infarctions. The record of a previous period of hospitalization included a history of dyspepsia and the description of an attack of epigastric pain with belching that was ascribed to a chronic cholecystitis, although no pathologic changes were observed in the gallbladder at postmortem. Unfortunately, there was no roentgen examination of the stomach. It is possible that the large loose folds of mucosa did prolapse into the duodenum, interfered with the proper functioning of the pylorus, and produced the gastro-intestinal symptoms. Little credence, however, can be given this one incomplete case. It is recorded here, as it is the only one in which a postmortem specimen was obtained approximating a prolapse of the gastric mucosa as seen at operation.

From a summation of the findings at operation, the lack of pathologic infiltrations within the tissues, the anatomic construction of the stomach walls, and the passive and active movements of the mucosa, it appears that certain factors could influence or alter gastric peristalsis in a manner capable of bringing about sufficient stretching and loosening of the submucosa to provide the excessive mobility of the mucosa necessary for its prolapse or invagination into the duodenum. In other words, the structural conditions necessary for the development of a prolapse are inherent in the walls of the normal stomach, but a prolapse occurs only after the fibers in the flexible submucosa have been stretched and loosened by abnormal gastric peristalsis, which in turn is initiated by neurogenic or chemical stimuli or a combination of both.

Emotions such as worry, fear, excitement, and anger alter gastric function. Cannon (4) and more recently Wolf and Wolff (24) leave no doubt that emotions and the "state of well-being" enormously influence gastric peristalsis and chemistry. Wolf and Wolff even succeeded in producing ulcerations of the gastric mucosa by "worrying" their patients. Feelings of resentment or uncertainty or insecurity, of fretfulness, and of disappointment all have been heightened by the demands of the war and are reflected in gastric function. Similarly, "nervous" tension and "strain" have been intensified, and these also are capable of influencing gastric movements and chemistry. The irregular daily schedule of activities required in certain military and civilian occupations,

After a consultation with the surgical service it was decided that an exploratory operation should be done. On Jan. 4, 1944, Capt. A. M. French (MC) U.S.N.R. opened the duodenum and found, protruding into it, a large "collar" of prolapsed gastric mucosa. The "collar-like" mass of invaginated mucosa was resected and a Heineke-Mikulicz pyloroplasty was performed in closing the stomach. The duodenal mucosa and serosa were intact and free of any ulcer or ulcer scars. A cholecystectomy was also done because of adhesions about the gallbladder. The postoperative course was somewhat prolonged, as well as the period of hospitalization, as a full set of dentures was made.

Gastroscopic examination, postoperatively, by Capt. W. L. Voegtlin (MC) U.S.N.R. revealed no abnormality other than several mucosal hemorrhages in the antrum.

The patient was discharged to limited duty Aug. 30, 1944. He gained weight and tolerated a regular diet throughout his hospitalization without discomfort. Since then he has been subsisting partly at home and partly on regular Navy "chow" without a recurrence of symptoms. He has not missed a day at work and has received no medical treatment. He has gained 12 pounds in weight and feels well. He was last examined Dec. 13, 1944, about a year after operation.

This case again illustrates the importance of distinguishing between defects produced by ulcers and prolapses.

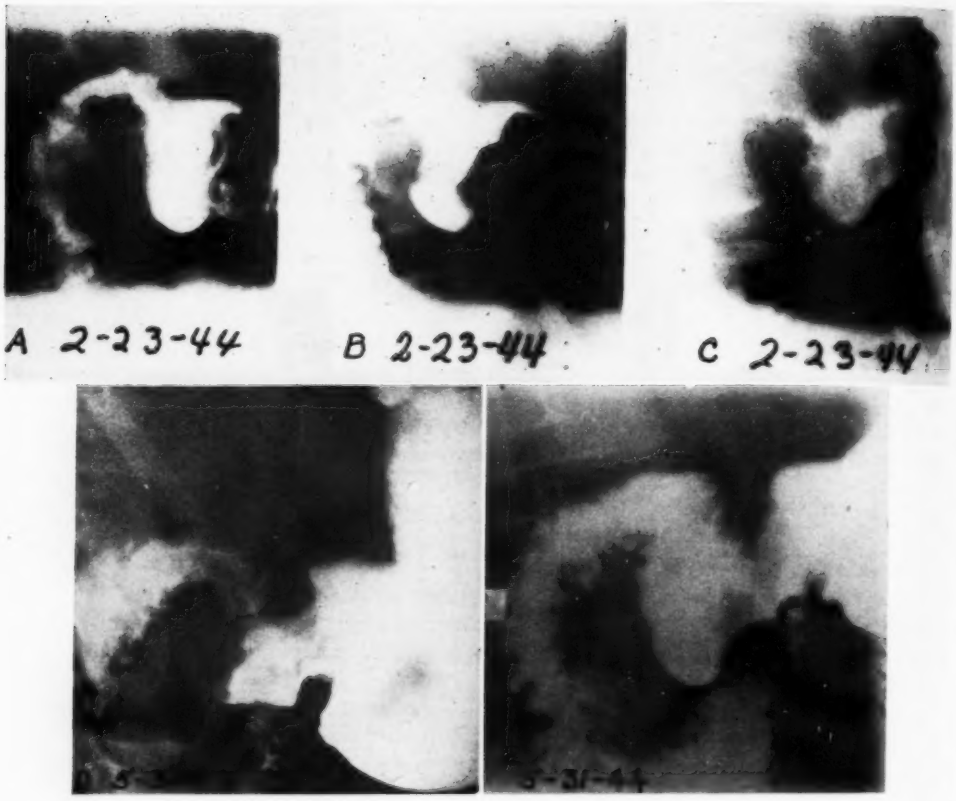

Fig. 9. Case III.

A, B, and C. A moderately large prolapse of the gastric mucosa fills the base of the duodenal bulb. Note particularly that the contour of the bulb is unchanged except at the base and, even when the bulb is distended with barium, the defect in the base can be recognized through the overlying contrast material. D and E are the postoperative films, after the prolapsed gastric mucosa was resected and a pyloroplasty performed.

Case History: This 34-year-old officer's illness began in February 1942 with "heartburn" and "acid stomach." The symptoms were unrelated to food but were partially relieved by soda and usually culminated in a feeling of weakness. At that time he passed two large tarry stools and was hospitalized for study.

An x-ray examination of the stomach revealed a deformed, slightly tender duodenal cap which was interpreted as indicating a duodenal ulcer, and this diagnosis was made a part of the record. Subsequent x-ray examination of the gastro-intestinal tract, two months later, showed the deformity of the duodenal cap still present. Improvement was observed on an ulcer regime, and the patient returned to duty at the end of six months. His symptoms disappeared except for occasional "acid stomach" that responded to cremalin or amphogel.

After a year on active duty at sea aboard a combat ship, the gastric symptoms recurred. While on a short leave, the patient was examined by a civilian roentgenologist, who reported a deformity of the duodenal bulb but was uncertain that the defect was due to an ulcer. The officer returned to his ship, and by February 1944 his symptoms were severe and no longer relieved by alkalies. He complained of a "knotting up" of his stomach, with acid eructations and a feeling of illness after eating only small amounts of food. While aboard ship he had been working strenuously and for long hours. His meals were irregular for days at a time. He got little sleep and only short periods of rest.

The patient was now sent to the hospital for evaluation of the suspected ulcer and disposition. He was depressed and discouraged, as he felt that his career as a naval officer was jeopardized by his illness and that it was a handicap to his promotion.

The physical examination and routine laboratory findings were negative. Occult blood was found in the stools on three occasions. The gastro-intestinal examination on Feb. 23, 1944, revealed a large protrusion of the gastric mucosa into the duodenum. The gastroscopic report of Capt. W. L. Voegtlin (MC) U.S.N.R. stated that the gastric rugae were large, and several of the folds appeared to extend into the duodenum. The remainder of the stomach was clear. The gastric acidity was within normal limits.

Because of the long duration and severity of symptoms, the persistent occult blood in the feces, and the opportunity of having the duodenal ulcer diagnosis removed from his record, the patient was operated upon by Capt.

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with disturbed rest, lack of sleep, excessive fatigue, and long periods of hunger, may be contributing factors. The excessive use of coffee, tobacco, and alcoholic beverages is well known to disrupt gastric function. Many of the factors just described entered into the experience of the patients in our series.

The one common denominator in the theories on the etiology of prolapse is an abnormal disturbance of gastric peristalsis and function. The most common, continuous, and effective means for altering gastric function springs from the emotions and the nervous system. Consequently, in view of the construction of the stomach walls, which normally permits a degree of mobility between them, it seems possible that certain neurogenic factors are the inciting cause of a disturbed gastric function that ultimately brings about a mucosal prolapse. A pre-existing disease process is not necessary for the production of a prolapse of the gastric mucosa.

SYMPTOMATOLOGY; PHYSICAL AND LABORATORY FINDINGS

The complaints of these patients are varied, being influenced by the extent and the condition of the prolapsed mucosa. The symptoms are not so stereotyped or characteristic as to permit a clinical diagnosis of the disorder. The diagnosis is made on the roentgenologic findings and the ruling out of other gastro-intestinal diseases. The symptoms recorded in the clinical charts were tabulated and are listed in Table II. The most common complaint was intermittent attacks of epigastric distress, cramp-like in nature, usually relieved by small amounts of bland foods or liquids, but seldom by alkalies. These symptoms closely resemble and in some instances are indistinguishable from those found in patients with peptic ulcer, duodenitis, and gastritis. This is probably due to the presence of very small superficial erosions or ulcerations on the prolapsed portion of the mucosa that has become irritated and edematous. This deduction is reasonable, since bleeding has occurred in some cases and a certain degree of erosion of the mucosa must have taken place for this to happen. Furthermore, the chemical factors in the duodenum are not favorable conditions for protruded gastric mucosa, nor is it in a desirable position, due to the "squeezing" action of the pyloric sphincter. Vigorous gastric peristalsis is usually present and accentuates these features. The intermittent character of the attacks, with intervals of freedom from symptoms and temporary improvement, is understood if one keeps in mind that the prolapses may occur intermittently and that the condition of the prolapsed mucosa may vary from time to time.

TABLE II: MAJOR SYMPTOMS COMPLAINED OF BY PATIENTS WITH PROLAPSE OF THE GASTRIC MUCOSA

(Most patients had two or more of the symptoms.)

Intermittent epigastric distress; cramping pains	14
Relief by food	10
Sense of fullness, bloating, heartburn	9
Nausea and vomiting	4

A "feeling of fullness" after eating even small amounts is a common symptom, probably due to an interference in the passage of food through a pylorus partially clogged with redundant mucosa. Nausea and occasional vomiting occurred in four patients.

The disorder should be suspected in patients with an atypical ulcer history, in

A. M. French (MC) U.S.N.R. on Feb. 29, 1944. The duodenal bulb was smooth and free of scars, adhesions, or "stippling" on the outside, and no evidence of a healed or active ulcer was found on the mucosa. Prolapsed gastric mucosa filled the base of the bulb. It, too, was free of ulcerations and was excised. A Heineke-Mikulicz pyloroplasty was done in closing the stomach. The postoperative course was satisfactory, and the patient was on sick leave in two weeks.

On March 1, 1944, the diagnosis in his health record was corrected to prolapse of redundant gastric mucosa, postoperative. He was discharged on June 13, 1944, and returned to active duty as First Lieutenant and damage control officer aboard a cruiser, which is one of the most strenuous positions aboard a combat ship. A letter from his father, a Captain in the Medical Corps of the Navy, dated Sept. 12, 1944, stated that the ex-patient had been promoted to Commander and, to quote, "letters from Jack indicate he is in the pink of condition." Subsequent correspondence indicated that he had been symptom-free for almost a year.

The history of this officer illustrates the importance of accurately identifying a prolapse of the gastric mucosa and distinguishing it from a duodenal ulcer. This man's future was largely dependent upon the diagnosis of a condition which was amenable to surgery and permitted him to return to an active naval career.

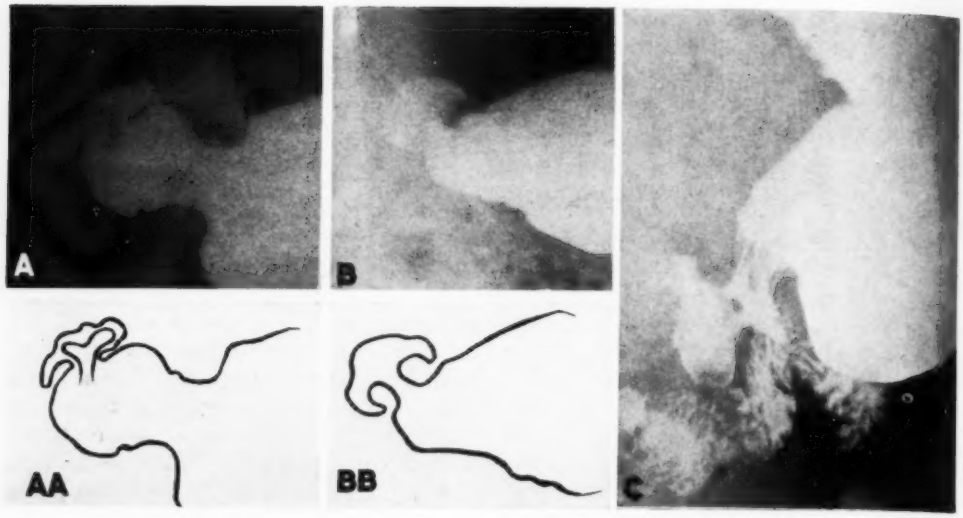

Fig. 10. Case IV.

A moderate prolapse of the gastric mucosa was demonstrated with difficulty in this patient, as his large size was almost beyond the capacity of the x-ray equipment. There was a constant negative defect, varying somewhat in size and contour, in the base of the duodenal bulb, due to a prolapse of the gastric mucosa, confirmed at operation (see Fig. 3). This case is not included in the original series, but is recorded here because it was confirmed by operation.

Case History: The patient was a 31-year-old seaman who had been in the Navy seven months and at sea for the past five and a half months. Shortly after he was assigned to a ship, he began having "stomach trouble" characterized by attacks of abdominal discomfort every three or four days. He described the distress as a "slow" pain in the lower abdomen, usually coming on about an hour after meals and lasting about thirty minutes. Alkalies did not relieve the distress. Food and milk were not tried. The pain did not waken him from sleep. He stated that he suffered from seasickness at times but thought his trouble was more deep-seated.

The attacks of abdominal pain became more severe, and on Sept. 17, 1944, the patient turned into sick bay. The entry in his health record read: "He vomited at noon and several times thereafter, the vomitus on one occasion containing approximately 250 c.c. of dark red blood." Physical examination was negative except for tenderness in the epigastrium. He was put to bed and given morphine.

Later that day the patient was transferred to a shore dispensary for observation. An x-ray examination of the stomach the next day was negative, and a tentative diagnosis of acute gastritis was made. After two weeks on a soft diet, the symptoms disappeared and the man was returned to the ship.

On Nov. 8, 1944, about two months later, the attacks of dull epigastric pain recurred and the patient was sent to this hospital for consultation and treatment. The physical findings and routine laboratory examinations were negative. Gastric analysis revealed a peak of 34° of free HCl at two hours. The x-ray examination of the stomach showed a deformity in the base of the duodenal bulb due to a prolapse of redundant gastric mucosa. Gastroscopic examination by Capt. Walter Voegtlin (MC) U.S.N.R. revealed a normal appearing stomach except for an excessive "rosette" formation about the pylorus during systole, which he considered suggestive but not diagnostic of redundant gastric mucosa.

A consultation was held with the surgical service. Operative treatment was advised because of the persistent symptoms, failure to respond to medical treatment, hematemesis, and the x-ray findings of a prolapse of the gastric mucosa. On Dec. 2, 1944, Capt. A. M. French (MC) U.S.N.R. explored the stomach and duodenum. A large protruding "collar" of gastric mucosa was found in the duodenum. This was photographed in still and motion pictures (Fig. 3). The redundant gastric mucosa was resected and the stomach closed following a Heineke-Mikulicz pyloroplasty. The postoperative course was prolonged by the development of pneumonia, but otherwise improvement was rapid. The patient has now been on a regular diet and free of symptoms for over six months.

those that do not make the usual response to an ulcer regime, in those with repeated recurrences when placed on solid foods, and in those with recurrent "functional complaints."

Reports of the physical examinations revealed no consistent abnormalities of significance other than tenderness in the epigastrium on deep palpation. Absence of physical defects and disorders is to be expected among military personnel composed largely of selected young adults.

The routine laboratory examinations of the blood and urine were within normal limits. Secondary anemia due to prolonged bleeding was not found in any pa-

tient. The serological tests for syphilis were all negative. Over two-thirds of the gastric analyses were within the normal range or below, while one-third showed hyperchlorhydria. Occult blood was found in the stools of two patients.

Oral cholecystograms demonstrated normally functioning gallbladders in every instance. No abnormal lesions of the colon were detected with the aid of barium enemas.

Gastroscopic examination of the stomach was not available until the latter part of this study. In these patients examined by Capt. W. L. Voegtlin (MC) U.S.N.R. no consistent abnormalities were noted. In one case the appearance of the gastric mucosa was suggestive of hypertrophic gastritis, but not sufficiently characteristic to warrant that diagnosis. Positive recognition of folds of redundant gastric mucosa slipping through the pylorus was not obtained. The value of gastroscopy has been to rule out a gastritis as the cause of the symptoms. It should be done whenever practicable.

DIAGNOSIS AND ROENTGENOGRAPHIC FINDINGS

While the diagnosis of a prolapse of the gastric mucosa into the duodenum can be suspected from the clinical history, it is established by the roentgen examination. The appearance at fluoroscopy and on the roentgen film is quite characteristic and is easily recognized if one keeps in mind the pathology of the disorder and the following features:

1. The filling defects in the duodenal bulb due to the prolapsed gastric mucosa are invariably in the base, immediately around the pyloric opening. The redundant folds of mucosa within the bulb produce a central "mushroom-" or "cauliflower-like" negative shadow of a lobulated appearance (Figs. 7, A; 8, B; 9, A; 10, A; 11, A). Rarely, if ever, do duodenal ulcers produce a filling defect of this character (Figs. 12, A and 13, C).

2. The filling defects vary in size, shape, and appearance during a single examination and on repeated examinations, as the folds of redundant mucous membrane are soft and pliable. The degree and extent of the prolapse may vary from time to time or it may even become temporarily reduced during an examination or at later examinations. Such variations in contour and size are well demonstrated in Figures 7, 8, 9, and 11. These are the basic points in the roentgenologic differentiation from duodenal ulcers that are constant and unchanging at any one examination.

3. Usually the redundant gastric rugae can be traced from the antral canal through the pyloric opening into the base of the duodenal bulb. The prolapsed folds appear as wide dark spaces between the thin threads of barium that are in the valleys on either side (Figures 7, B-D-E; 8, A-B; 9, B; 11, C). Their visualization can sometimes be enhanced by exerting moderate compression over the pylorus and bulb. The rugae in the prepyloric portion of the stomach do not appear abnormal or particularly large.

Prolapses of the gastric mucosa must not be confused with a single prominent gastric ruga that is normally and frequently seen extending across the pylorus into the base of the duodenal bulb (Fig. 13).

4. With prolapse, the duodenal bulb is not "quick" or irritable and usually retains the barium, permitting prolonged examination, in contradistinction to the behavior of the bulb with an active ulcer or duodenitis. In all three disorders moderate tenderness can be elicited by deep pressure over the bulb.

5. Gastric peristalsis in most cases is more active and vigorous than is usually seen in the average patient.

6. No ulcer "craters," "niches," "incisura," or radiating rugae were seen in the central negative filling defects opposite the pylorus caused by the prolapsed mucosa. They should be sought, however, as Melamed and Hiller (14) report one case in which a large ulcer was demonstrated radiographically on the prolapsed mucosa and confirmed at operation. Rubin (20)

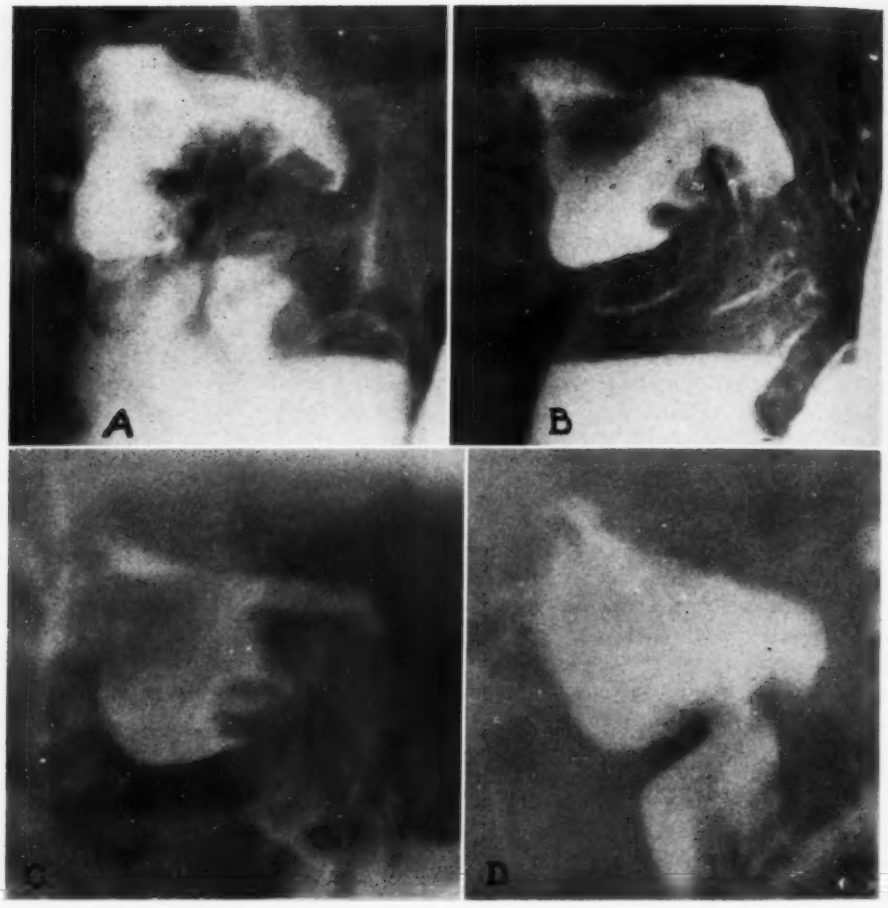

Fig. 11. Case V.

The typical negative "cauliflower-like" defect of a prolapse of the gastric mucosa is demonstrated in A and C. In B and D the defect is still present but has varied in size and contour, as the prolapsed folds are soft and flexible as well as partially reducible, as shown in D.

This case is not included in the original series, but is recorded because it was confirmed by operation.

Case History: A chief aviation radioman, 27 years of age, entered the Seattle Naval Hospital on March 6, 1945, complaining of recurrent attacks of epigastric pain over a period of seven months. They occurred at intervals of about two weeks, lasted four or five days, and then disappeared. Some attacks continued as long as two weeks. They usually began on an empty stomach and were temporarily relieved by food or alkalies. Highly seasoned or greasy foods caused increased discomfort. The patient vomited occasionally and upon one occasion thought the vomitus contained a little blood. His appetite was good and he had lost no weight. He had no bowel complaints. He had had three attacks of malaria, the first on June 7, 1943.

The patient was a well nourished and well built young man with no abnormal findings on physical examination. Routine laboratory procedures were within normal limits, including gastric analysis. Some benefit was obtained from a bland diet, but the patient never became symptom-free.

Prior to admission on Feb. 21, 1945, a diagnosis of prolapse of the gastric mucosa into the base of the duodenal bulb was made following x-ray examination at this hospital. This was confirmed on re-examination, March, 21, 1945. X-ray examination of the gallbladder showed normal function.

On April 3, 1945, a pyloroplasty was done, with removal of the redundant gastric mucosa, which had prolapsed into the base of the duodenal bulb. No evidence of duodenal ulcer or hypertrophic gastritis was found. The gastric rugae were large but soft and freely movable on the muscularis.

Pathologic examination of the resected tissue by Capt. Clyde Jensen (MC) U.S.N.R. revealed a mild infiltration of plasma cells throughout the mucosa and submucosa which microscopically resembled the changes seen in an early and mild gastritis.

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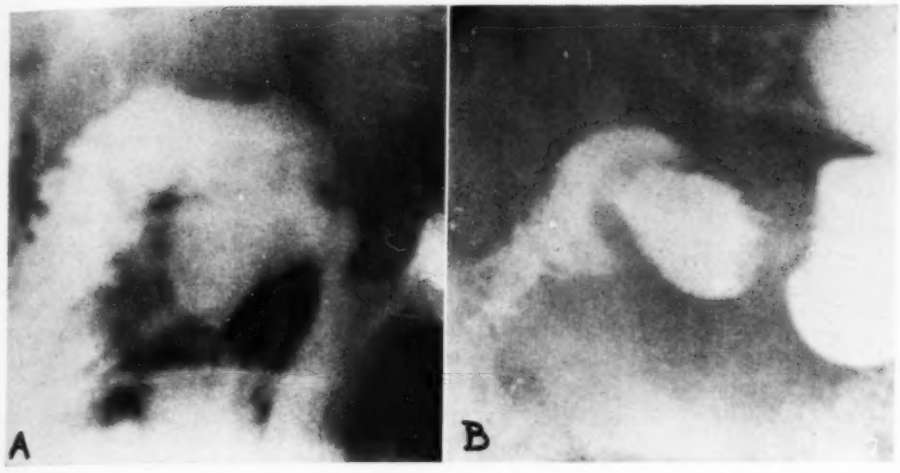

Fig. 12. Defects in the duodenal bulb that should not be confused with a prolapse of the gastric mucosa
A. A duodenal ulcer in the base of the bulb does not produce a negative "cauliflower-like" defect but usually produces an incisura on the side of the bulb, as demonstrated here, or an ulcer crater, as shown in Figure 13, C.
B. Occasionally a basal view of the bulb pictures it as being smooth and concave with a narrow pyloric opening. This appearance of the bulb should be distinguished from that produced by hypertrophy of the pyloric muscle in adults, as described by Kirklin and Harris.

reported a case with proved malignant changes in the prolapsed polypoid mucosa.

7. Fluoroscopy supplemented by serial "spot films" is the method of choice for demonstrating prolapses, as a series of films is obtained at the moment the bulb and pylorus are best visualized. Films are also taken in various phases of peristalsis. It is essential that films be made in every case, since the filling defects caused by a prolapse can be overlooked at fluoroscopy, as has been pointed out by others.

8. In contrast to the experience of some, the prolapsed folds of gastric mucosa can be demonstrated with the patient standing, as well as in the prone position. No appreciable difference was noted in the appearance of the filling defects when small amounts of barium were used and large amounts, with the stomach fully distended.

In addition to duodenal ulcers, the filling defects produced by prolapses of the gastric mucosa must be differentiated from other duodenal lesions. The diagnoses made on patients in this series prior to the recognition of the defect as being due to a prolapse of the gastric mucosa were as follows:

Gastric ulcer	1
Duodenal ulcer	11
Duodenitis	2

Most of the patients in the series had received a previous roentgenologic examination of the stomach and duodenum at which the above diagnoses were considered. These figures emphasize the importance for accurately recognizing prolapses of the gastric mucosa and distinguishing them from other disorders.

The most difficult lesions to differentiate are the *prolapsed pedunculated gastric tumors and polyps.* Those (15, 16, 17, 18) who have observed them were unable to distinguish them from prolapsed gastric mucosa with any degree of certainty, which is another reason for reporting the occurrence of gastric prolapses.

The patient was ambulatory by April 17, 1945, and although he experienced some pylorospasm, this was relieved by tincture of belladonna. On May 25, 1945, an x-ray examination showed a normally functioning stomach and duodenal bulb, with little deformity of the stomach due to the pyloroplasty. The patient was discharged to duty on May 28, 1945, without complaint and has gone along without symptoms on the regular Navy "chow" for over four months, with a gain of 17 pounds in weight.

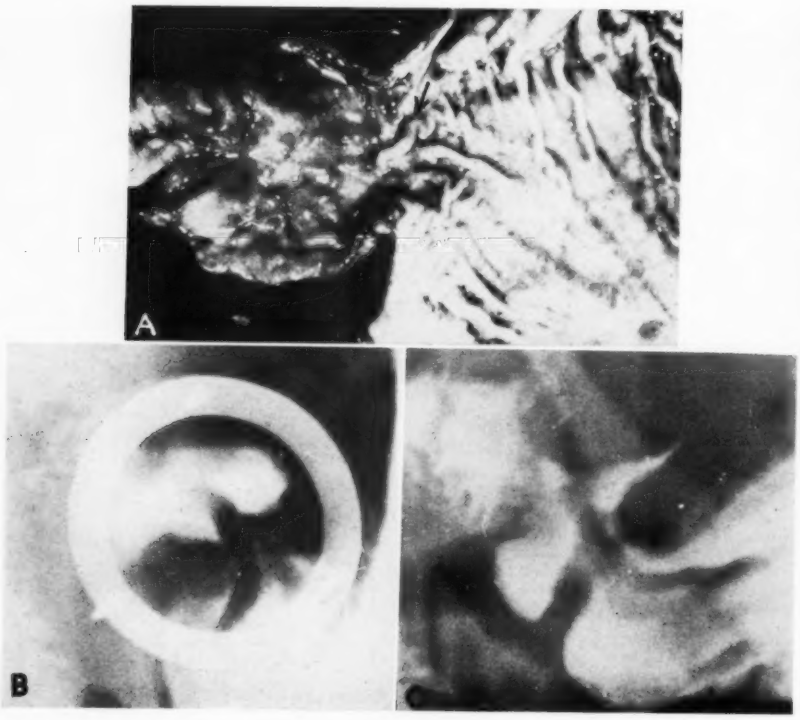

Fig. 13. A small fold of gastric mucosa is frequently seen in the pylorus extending into the bulb and is not a prolapse of the gastric mucosa.
A. Photograph of autopsy specimen which shows the anomalous fold of gastric mucosa on the posterior wall that is frequently found projecting into the duodenum.
B. Roentgenogram made antemortem, demonstrating the anomalous fold of gastric mucosa projecting into the bulb.
C. Duodenal ulcer with small crater, with the single gastric ruga leading nearly to it, similar to that in A.

Papillomata of the duodenum, as described by Waters (23) and Schons (22), produce filling defects that would be confusing. They appear, however, from reproductions to be larger and are not necessarily localized to the base of the bulb.

Duodenitis does not offer a difficult differential problem. Kirklin (11) describes the roentgen finding as a small, spastic, irritable, rapidly emptying duodenal bulb that varies in contour from moment to moment and possesses a coarse, irregular, reticular mucosal pattern—almost the opposite behavior from that of a gastric prolapse. In our experience the duodenal bulb in duodenitis is not always small, but may be of average size.

Hypertrophy of the pyloric muscle in adults, as reported by Kirklin and Harris (12), produces an invagination of the base of the duodenal bulb similar to that of prolapsed mucosa, but this defect lacks the central negative shadow and lobulations of the gastric rugae (Fig. 12, B). Furthermore, with hypertrophy of the pyloric muscle the filling defect in the duodenum is constant in size and shape.

In the *hypertrophic types of gastritis* the rugae may become large enough to protrude into the duodenum and be indistinguishable from a slight prolapse. A gastroscopic examination quickly settles this differential diagnosis, showing the giant rugae mentioned by Kantor and the mass of redundant gastric mucosa described by Moersch and Weir. The same is true for

the idiopathic benign hypertrophic pyloritis of Cunha (6).

Normal variations in the appearance of the pylorus and the base of the duodenal bulb might be confused with slight protrusions of the gastric mucosa. To study these more thoroughly, radiographic examinations of the stomach were made in over 200 sailors and marines who had returned from combat and were free of gastric symptoms. They were on the surgical wards with fractures, shrapnel wounds, etc. The duodenal bulbs showing the largest irregularities in the base are reproduced in Figure 14. At the most, they exhibit a "puckering" at the opening into the duodenum or small indentations from the pyloric muscle. In this group, one duodenal bulb was found with a small deformity from a healed ulcer, but no prolapses of redundant gastric mucosa were present.

One type of normal variation in the appearance of the duodenal bulb that might be confused with a prolapse of the gastric mucosa is the normal concave shape of the bulb when viewed obliquely from the base, as shown in Figure 12, B.

The production of a prolapse of the gastric mucosa is necessarily a slow process if it takes place by any one of the suggested methods or combinations of them and, within limits, it is probably slowly progressive. It may be recognized by radiographic means in the early stages when the gastric mucosa first protrudes through the pylorus into the duodenum, as is seen in Figures 15, 16, and 17. It is the slight and moderate prolapses that form the bulk of this series and that most commonly produce the filling defects which are confused with those caused by duodenal ulcers and duodenitis. It is important that roentgenologists report these early protrusions so that the gastroenterologist can determine if they are causing symptoms. Thus a sufficient number of cases can be accumulated for proper evaluation as well as for autopsy studies.

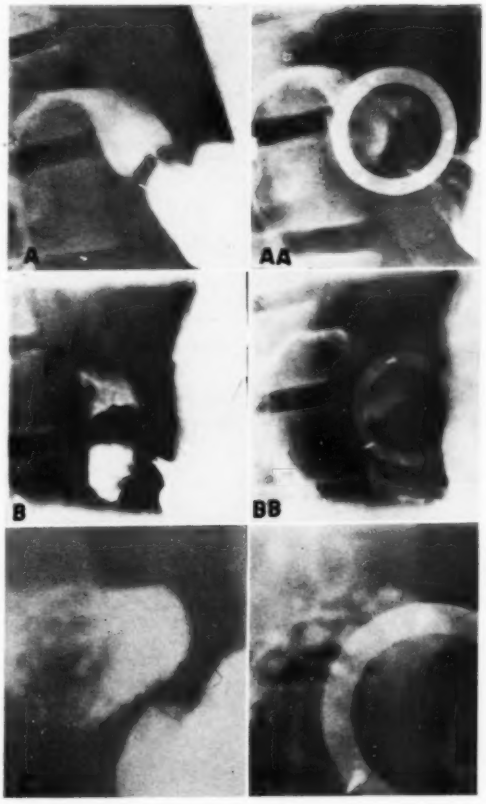

Fig. 14. In an effort to determine if prolapses of the gastric mucosa were present in individuals free of gastric symptoms, 200 consecutive marines and sailors who had just returned from combat duty with gunshot and traumatic injuries were examined without revealing an instance of gastric prolapse.

The duodenal bulbs in this figure are those which show the deepest irregularities at the base and are certainly normal. Each bulb is demonstrated without pressure (A, B, C) and with pressure (AA, BB, CC).

CLINICAL EVALUATION AND TREATMENT

The clinical evaluation of patients with prolapse of the gastric mucosa is determined by the internist or gastro-enterologist in charge. The clinical work-up on our patients included the history, physical examination, and routine blood and urine analyses. Most of them had a gastric analysis, oral cholecystography, a barium examination of the colon, and a gastroscopic examination. If the symptoms were sufficiently severe or persistent or if bleeding or obstructive signs occurred, a consultation was held with the surgical service to decide if operative procedures were necessary. The cases were evaluated in this manner as follows:

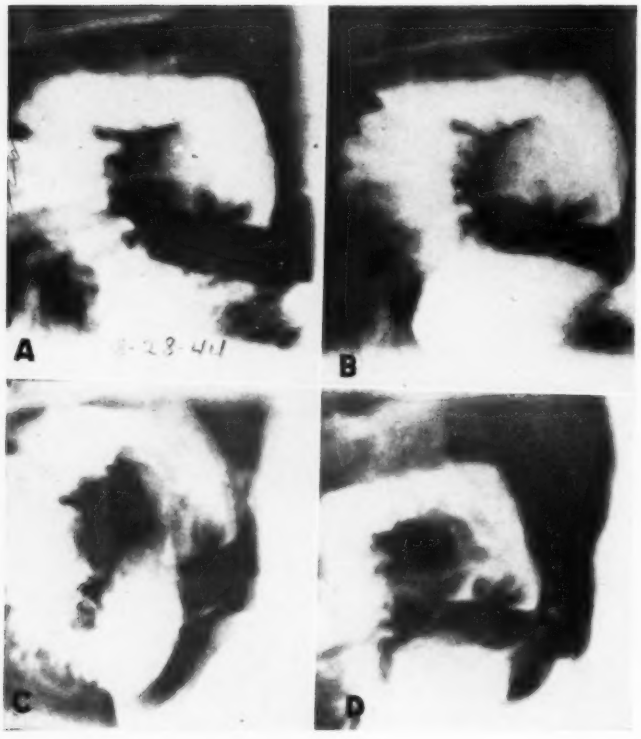

Fig. 15. Case VI.

The films demonstrate the typical negative "cauliflower-like" shadow of a mild prolapse of the gastric mucosa. The protruding gastric mucosa is in the form of a collar, as shown by the multiple folds of gastric rugae.

Case History: On Aug. 22, 1944, a 38-year-old seaman presented himself at a medical dispensary complaining of epigastric pains of two months' duration. The pains had become progressively worse and were aggravated by fatty or greasy foods. No vomiting had occurred. The discomfort was not relieved by food or alkalies. That day the patient was transferred to the hospital. He had experienced similar episodes at intervals during the past two years.

The routine physical and laboratory examinations were negative. The gastric analysis showed a peak of 36° of free HCl at three hours and 50° of total acidity. X-ray examination of the stomach revealed a small defect in the base of the duodenal bulb that was interpreted as a prolapse of redundant gastric mucosa. The roentgen examination of the colon was negative. The gastroscopic study on Aug. 29 was negative. The patient was placed on a medical regime similar to that described in the text but made a slow response. He was subsequently transferred to a convalescent hospital for continued treatment.

Operated	3
Refused operation	1
Operation contraindicated	1
Surgery recommended for recurrence	2
Moderately large prolapses (total including those listed above)	9
Slight prolapse	5

In 3 patients the symptoms were severe and persistent enough to require operation. Operation was recommended in one other instance, but was refused by the patient. In still another it was considered advisable but was contraindicated because of a severe psychosis. Two patients were discharged with the recommendation that, if rehospitalization became necessary due to a recurrence of symptoms or bleeding, surgical measures should be considered. A total of 9 had roentgen evidence of moderately large prolapses and 5 of slight.

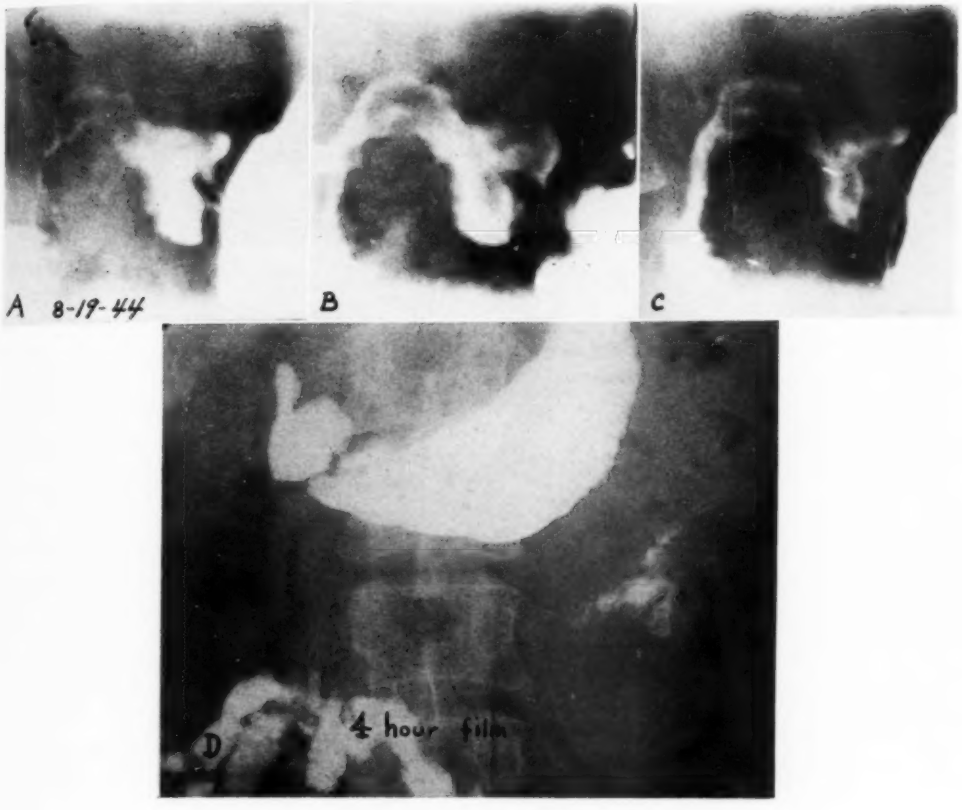

Fig. 16. Case VII.

An example of a slight protrusion of a single large gastric ruga. Note the constancy of the negative filling defect in the base of the duodenal bulb caused by this ruga. This patient was the only one of our series that had a four-hour gastric residue. It is possible that at times a fold of the protruding gastric mucosa becomes traumatized, swollen, and edematous from the passage of food and the action of the pyloric muscle. Such a mechanism would partially clog the pylorus and might be a factor in the production of gastric retention.

Case History: A 38-year-old medical officer wrote the following abstract of his history. "For the past month, epigastric pain, deep-seated, boring in nature, radiating upwards substernally and to the precordium; paroxysmal, lasting only a few moments at a time; not relieved by food but occasionally by alkalies. No relation to change of position. Have had minor attacks lasting several days at a time." No discomfort developed from alcoholic beverages in moderate amounts. About six months earlier a gallbladder examination was negative. Cardiac examinations were all negative.

The patient presented himself at the x-ray department for a complete gastro-intestinal series and for another oral cholecystographic test. The results were negative except for a small filling defect in the base of the duodenal bulb opposite the pylorus, which we felt was due to a small prolapse of redundant gastric mucosa. A previous roentgen diagnosis elsewhere had been duodenal ulcer.

Gastric analysis revealed a peak of 54° of free HCl and a total acidity of 70°. The colon examination with a barium enema was negative. Gastroscopic examination was refused by the patient. He was placed on an advanced ulcer regime without alkalies, and gradually the attacks of epigastric pain subsided. Unfortunately, before a re-examination of the gastro-intestinal tract could be made, he was ordered to sea duty, which prevented further follow up.

In slight and in some moderate prolapses, frequent feedings and a bland diet similar to that of an advanced Sippy program afford relief. Hospitalization, with attendant rest in bed, relaxation, and freedom from tension, strain, fear, and worry, brings improvement. Condiments, tobacco, alcohol, and caffeine should be eliminated. Mild sedation may be of value. These and other medical measures should be tried and when the patient becomes asymptomatic he may be returned to duty. He

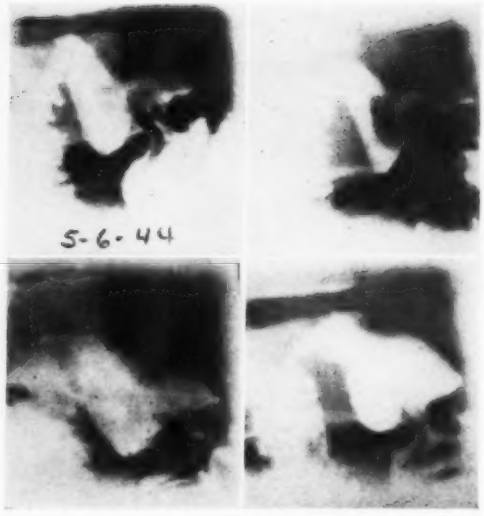

Fig. 17. Case VIII.

Slight to moderate protrusion of the gastric mucosa into the base of the duodenal bulb. The redundant gastric rugae are well visualized, protruding through the pylorus into the duodenum. No ulcer crater, niche, or incisura is present. This type of filling defect in the duodenum has been frequently interpreted as due to a duodenal ulcer, which it is not.

Case History: A 24-year-old seaman had been on duty in the South Pacific for seven months. In 1942, prior to enlisting in the Navy, he was told by a doctor that he had an ulcer. The doctor took no roentgenograms but put the patient on an ulcer diet, with improvement. He was sent into this hospital on April 7, 1944, complaining of epigastric pains and distress of two to three months' duration. The routine physical and laboratory tests were negative. Captain W. L. Voegtlin (MC) U.S.N.R. reported that the gastroscopic appearance of the stomach was normal. There was a slight gastric hypoacidity, with a peak of 27° of free HCl at the end of three hours. Upper gastro-intestinal series on April 12, 1944, and May 19, 1944, revealed a constant but slightly variable filling defect in the base of the duodenal bulb opposite the pyloric opening that was considered to represent a slight prolapse of redundant gastric mucosa.

In the summary of this patient's period of hospitalization, the gastro-enterologist expressed doubt that an ulcer had ever been present. The patient was given a leave transfer to another hospital with the recommendation that he be returned to full duty when asymptomatic. If a recurrence developed it was recommended that he receive a surgical consultation for consideration of the advisability of an exploration.

may then be able to get along by maintaining good dietary habits, obtaining adequate rest, and avoiding emotional upsets. If not, another period of hospitalization may succeed. Every patient with a prolapse of the gastric mucosa should receive the benefit of a trial on a medical regime before surgical measures are contemplated. Even repeated attempts to control symptoms by medical means are well worth while. With further recurrences or with severe symptoms, surgical measures must be considered.

The large prolapses have always produced symptoms of sufficient intensity and constancy to warrant operative procedures. Large hemorrhages or repeated small ones are also indications for surgery. The same is true of the development of a partial pyloric obstruction with abnormal retention of the gastric contents.

The surgical procedures are not standardized but usually include a resection of the prolapsed mucosa and some form of pyloroplasty. Rees (19) recommends an antral gastrostomy, excision of the redundant mucosa, anchorage of the mucosa to the muscularis, and sectioning of the pyloric muscle. A practical point of interest to the surgeon is that the prolapsed mucosa is difficult to palpate through the intact duodenum and can be overlooked unless it or the stomach is opened for inspection (8, 19).

In the 3 patients operated upon in this series, and in the 2 cases that were operated upon later but are reported here, Capt. A. M. French (MC) U.S.N.R. resected the redundant mucosa and in the last 4 cases did a Heineke-Mikulicz pyloroplasty. On the first patient he resected the offending mucosa and did a Finney pyloroplasty. All the patients had uneventful postoperative courses and to date have been completely cured and able to subsist on regular diets.

COMPLICATIONS

Complications were present in 6 patients as follows:

Positive gastro-intestinal bleeding	3
Gastric retention	1
Coexisting duodenal ulcer	1
Coexisting gastric ulcer	1

In 3 cases physicians had recorded the occurrence of gross gastro-intestinal bleeding as seen in the vomitus or in tarry stools. Hemorrhage is an important complication

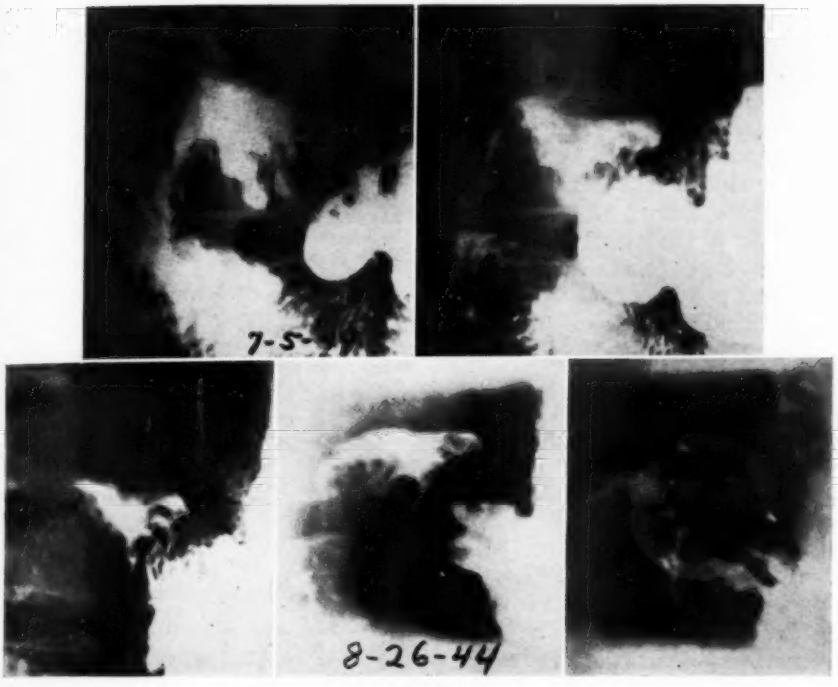

Fig. 18. Case IX.

A slight prolapse of the gastric mucosa into the duodenum occasionally occurs with a duodenal or gastric ulcer. In this patient the deep incisura from the scar of a duodenal ulcer was easily recognized, as well as the many redundant rugae in the base.

Case History: A 34-year-old seaman was admitted to this hospital on June 29, 1944, with the diagnosis of duodenal ulcer, which had been previously established from a roentgen examination. He had experienced intermittent attacks of epigastric pain for the last twelve years. The symptoms were about the same. Some seven years before admission he consulted a civilian physician, who made the diagnosis of ulcer. The patient has been on and off a Sippy regime as his symptoms varied in intensity.

A physical examination revealed no abnormal findings. The routine laboratory examinations were negative. A gastric analysis revealed a high of 58° of free HCl and a total of 70° combined at the end of two hours. A gastroscopic examination by Capt. Walter Voegtlin (MC) U.S.N.R. showed a normal appearing gastric mucosa.

After a period of hospitalization with considerable improvement, though the patient never became asymptomatic, he was surveyed by a medical board and discharged from the service.

and is not uncommon in the experience of others (1, 2, 7, 17, 18).

Gastric retention was present in only one patient with a moderate prolapse, although a 500 c.c. barium meal was used and the gastric motility film taken at four hours. In the cases reported by Archer (1) and Pendergrass (7, 17, 18), a gastric residue was a common and significant feature.

One patient with a gastric ulcer and one patient with a duodenal ulcer had prolapses of slight extent. The prolapses were regarded as incidental to the peptic ulcers, although these patients did not become completely asymptomatic after healing of the ulcers as shown by x-ray examination.

SUMMARY AND CONCLUSIONS

1. Prolapses of the gastric mucosa are not rare. In a group of adult males prolapse of gastric mucosa occurred as frequently as gastric ulcer.

2. Prolapse of redundant gastric mucosa produces symptoms that may be suggestive but are not characteristic enough to permit a clinical diagnosis. The condition should be suspected in duodenal

ulcer patients with atypical histories, in patients that are refractory to an ulcer regime, and in those who have recurrences when placed on solid foods.

3. The diagnosis of a prolapse of the gastric mucosa is established largely by the roentgen examination. The filling defects are characteristic and should not be confused with those produced by duodenal ulcers, duodenitis, or other disorders of the duodenum and pylorus.

4. The typical filling defect in prolapse of the gastric mucosa is a negative "cauliflower-like" defect in the base of the duodenal bulb opposite the pylorus, varying in size and shape during a single examination and on repeated examinations. These defects can be overlooked at fluoroscopy and films should always be made. Fluoroscopy supplemented by "spot films" is the most desirable method of examination.

5. Since large prolapses of the gastric mucosa can produce symptoms, are a cause of gastric hemorrhage, and may result in a partial pyloric obstruction, the roentgenologist should be on the lookout for them, distinguish them from other duodenal defects, and report them to the referring physician for evaluation.

6. The treatment in early and moderate prolapses is medical until such time as repeated and severe attacks or complications occur. In the large prolapses and in those complicated by repeated hemorrhages or partial pyloric obstruction, surgical measures are indicated. They include excision of the redundant folds of mucosa and usually a pyloroplasty.

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Tuberculous Arthritis of the Shoulder[1]

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THE INDIVIDUAL roentgen signs which characterize tuberculous arthritis are not, when taken singly, pathognomonic of the disease. When studied in the combinations and sequences in which they appear, however, they furnish sufficiently reliable evidence to permit an accurate diagnosis. The life history of a progressive tuberculous arthritis of the shoulder is presented. The roentgenograms are of interest because they illustrate many of the common denominators which characterize tuberculous arthritis in any joint.

CORRELATION BETWEEN THE CLINICAL, PATHOLOGIC, AND ROENTGENOLOGIC FINDINGS

Tuberculosis in a joint is a metastatic process. In the adult the primary source of infection is usually the lungs. In children it is almost always an infected lymph node (3). The metastatic focus may be in the synovial membrane or in the bone contiguous to it. The exact primary localization in the joint, however, appears to be of only academic interest. When the diagnosis of joint tuberculosis is made, both structures have already been invaded (1, 2, 6).

The insidious onset of tuberculous arthritis usually precludes early diagnosis. There gradually inserts itself into the consciousness of the patient an awareness of disability or pain. At this early stage tuberculous granulations may be present over the cartilaginous surface of the joint (4, 5, 6). The gross pathologic changes will be insufficient to be visibly reflected on a roentgenogram. There may result some clouding or an increase in the amount of fluid within the joint, but in many sites, as the shoulder or wrist (7), this may easily escape detection. In any case these findings are not specific. Likewise, early osteoporosis is neither invariably present nor specific. It may be so slight that it will not be recognized without comparative study of an opposite or contiguous member. Narrowing of the joint space due to cartilage destruction is not a characteristic of early tuberculosis. Tuberculous granulation may therefore be present in a joint without giving sufficient or specific changes which may be demonstrated roentgenologically. Tuberculous arthritis is to be suspected in any patient with pulmonary tuberculosis who complains of prolonged disability or pain in a joint. A negative roentgenogram is by no means conclusive, and follow-up studies are indicated (Fig. 1). In children the clinical diagnosis may not be suspected until the roentgenograms are more characteristic.

As the process becomes more advanced, subchondral granulations develop, which undermine the joint cartilage at its attachment to the cortical bone (4). The cartilage may lie partly free in the joint space, but its destruction may be slow because of the absence of proteolytic ferments in tuberculous joints (4). Consequently the joint space may be maintained for an additional interval in spite of the presence of an active joint lesion. If there is beginning narrowing of the joint space, it is never of the degree which is commonly found with pyogenic infection at the same stage of disease. Concurrently, the contiguous underlying cancellous bone is involved in the morbid process (1, 2, 6). An important finding is the thinning or destruction of the bony articular cortex. Reactive periosteal changes or osseous productive changes are usually, but not invariably, absent. Osteo-

[1] From the service of Dr. A. L. Bachman (now with the Armed Forces), Department of Roentgenology (Dr. I. Startz, Director), Triboro Hospital for Tuberculosis, Jamaica, N. Y., Department of Hospitals, New York City. (The patient was on the service of Dr. L. H. Bennett.) Accepted for publication in July 1945.

porosis, whether due to bony atrophy or disuse, or to a combination of factors, including a possible specific tuberculous toxin (7), becomes more marked.

At this stage of the disease the clinical and roentgenographic findings are more typical. The joint pain and disability have persisted too long for casual observation. On the roentgenogram the partial destruction of the bony articular cortex will be visible. It is the first positive roentgen sign which indicates organic destruction at the joint. According to Phemister (4), this occurs from four to twelve months after the onset of the disease. While the osteoporosis may be vague, or the narrowing of the joint space absent or equivocal, the partial destruction of the bony cortex is a startling finding which cannot be disregarded (Fig. 2).

Inevitably, as the disease progresses, the opposing surface of the joint is invaded. At the shoulder, if the initial involvement was at the humeral head, the glenoid portion later follows a parallel morbid course. At the same time the slow destruction of the cartilage continues. There is no reason to expect an even destruction of articular cartilage, and the resultant narrowing of the joint space will not be uniform. Phemister (4, 5, 6) stresses the important role that the mechanical forces may play in determining the site and degree of cartilage destruction. When the tuberculous granulations overgrow the free cartilage surface, they erode it from the joint surface inward. Pressure from an opposing cartilage is said to prevent an overgrowth of granulation and therefore result in a longer preservation of that portion of the cartilage. In general, the areas of greatest pressure are usually in the central area of the joint. Ghormley, Kirklin and Brav (2) compared tuberculous with non-tuberculous diseased knee joints. They found that in non-tuberculous infections the greatest destruction is almost invariably central, while in the tuberculous cases it may be either central or peripheral. While mechanical forces may play an important role in determining the site and rate of cartilage destruction, it would be futile to depend upon this as the exclusive explanation. Many factors, such as the virulence of the disease and the resistance of the local tissue, surely play a significant part. In any case, in the shoulder, where mechanical strains are more evenly distributed, the naturally haphazard spread of granulations is less affected by physical forces and the cartilage destruction appears to be without predictable pattern.

With the destruction of the cartilage, the narrowing of the joint space, and the invasion of the opposite side of the joint, there is a further increase in the involvement of the underlying cancellous bone. The cortex may now be almost completely destroyed. The contiguous bone is grooved and pitted. Irregular foci of rarefaction appear in the neighboring osseous areas (Fig. 3).

With a still further increase in the degree of invasion of the underlying bone, portions of it may become necrotic and sequestrate. The sequestrum may be delineated by a surrounding area of partial or complete rarefaction. Occasionally such areas of necrosis lie in opposition, on facing sides of a joint. They are spoken of as "kissing sequestra." The joint capsule is not immune and will eventually rupture. The joint detritus will then track through the perforation and gravitate along lines of least resistance. If the skin is perforated, secondary infection may result. The appearance will then become indistinguishable from that of other pyogenic infections. The destroyed joint relationships associated with muscle spasm will result in luxations and other deformities.

At this advanced stage the patient will not be able to raise the arm at the shoulder. Muscle wasting and spasm will be present. A soft-tissue mass will be palpable beneath the shoulder. The film will show complete destruction of the joint architecture. The joint space will be destroyed. Humeral luxation will be present. The underlying bone will show areas of necrosis and possibly sequestration. Rupture of the joint capsule will be indi-

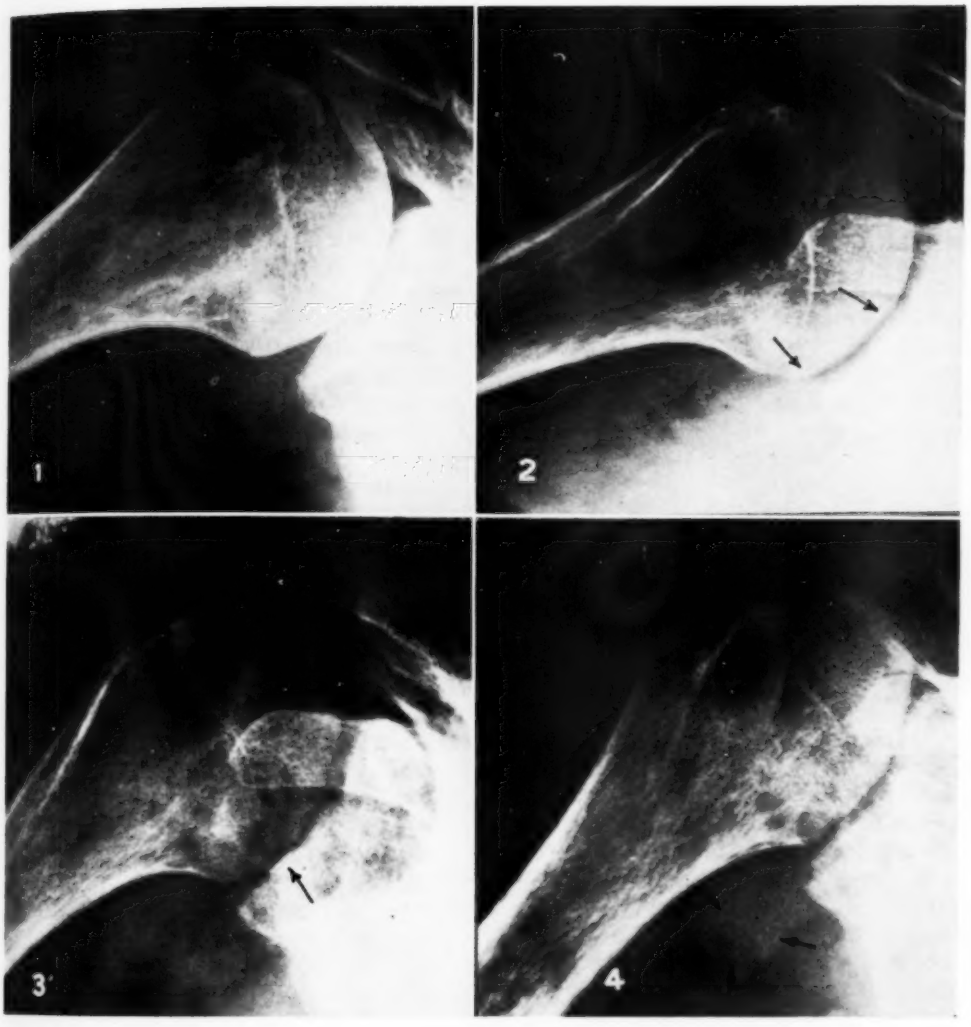

Fig. 1. *4-17-1944:* Tuberculous arthritis. Normal appearing shoulder which demonstrates that the presence of tuberculous arthritis cannot be excluded by a negative roentgenogram. The patient was a 54-year-old white male who had a far-advanced pulmonary tuberculosis. He had been complaining of shoulder pain for at least one month before this examination.

Fig. 2. *8-28-1944:* Four months later the same shoulder shows clear-cut roentgenologic evidence of disease. The humeral head cortex is eroded with the exception of a fragmented shell, which is indicated by arrows. The joint space is slightly narrowed. No reactive changes are noted. The coracoid process is seen well through the osteoporotic head of the humerus.

Fig. 3. *1-17-1945:* The disease has increased in severity. No part of the cortex of the humeral head remains intact. The osseous substance of the medulla has begun to erode. There is further destruction of the joint space. The kissing surface of the glenoid fossa is involved. Only a small fragment of cortical shell remains as indicated by the arrow. This appears to be sequestrated. The scapula beneath the glenoid cortex is involved. Osteoporosis is more marked. No reactive changes are seen.

Fig. 4. *1-31-1945:* Some luxation is present. A sequestrum appears to be present at the lower end of the glenoid. The bony debris which has resulted from the destruction of the osseous substance contiguous to the joint has collected in a dependent position, as indicated by the arrows. This could be felt as a painless fluctuant mass in the soft tissues at the upper end of the humerus. One month later the fluctuant mass was aspirated. The bacteriological smear was negative for pyogenic and acid-fast organisms. The culture was *positive* for acid-fast organisms. The patient suffered from a generalized hematogenous spread, as evidenced by the presence of laryngeal and epididymal tuberculosis, as well as tuberculosis in the opposite shoulder. He died two months after the last roentgenogram was made.

cated by a tracking of the debris to a point below the joint (Fig. 4).

DISCUSSION

No part of a joint is immune to tuberculous infection. If unchecked, the disease will ravage, with increasing severity, every portion of it. The encroachment does not proceed in stages and cannot be conveniently classified into exact pathological groups with corresponding roentgen findings. The rate of onslaught on the component joint structures varies among the joints, and from patient to patient in similar joints. There is some variation in children as compared to adults. It appears futile, therefore, to attempt a division of the process into definite stages where the roentgen appearance of the joint parts can be predicted. A knowledge of the morbid changes and the corresponding roentgen appearance of each part of the joint should, however, permit one to speak in general terms of early or advanced involvement.

The individual roentgen signs which have been described in this report have been studied by some authors who conclude that they do not occur exclusively in tuberculosis. While the individual signs are not pathognomonic, no false conclusions should be implied from this. When these signs are studied in the combinations in which they appear, they present enough accurate evidence to permit a confident diagnosis of tuberculous arthritis. The excellent studies in the bibliography are recommended with these thoughts in mind.

CONCLUSIONS

1. The life history of an actively progressive tuberculous arthritis of the shoulder is presented.

2. This illustrates, with slight variations, many of the common denominators which characterize tuberculous arthritis when found in any joint.

3. The following diagnostic features of tuberculous arthritis are demonstrated:

(*a*) A lag of roentgenologic evidence behind the clinical diagnosis. The first roentgenograms appear to be normal, although tuberculosis is undoubtedly already present. The joint space remains intact because the cartilages are destroyed slowly.

(*b*) Cortical erosion. The intact cortex remains as a fragmented shell. Destruction of the bony articular cortex may be the first sign of organic destruction at the joint.

(*c*) Osteoporosis. This becomes very marked as the disease progresses.

(*d*) Later loss of joint space due to cartilage destruction.

(*e*) Invasion of the underlying cancellous bone.

(*f*) Involvement of the opposing surface of the joint.

(*g*) Absence of reactive changes (not invariable).

(*h*) Necrosis of the underlying bone with sequestra formation.

(*i*) Accumulation of debris.

(*j*) Rupture of the joint capsule and tracking of the fluid and debris, with cold abscess formation.

(*k*) Luxation of the joint as its destruction continues.

4. Many of the sesigns appear concurrently. They increase in intensity with the increasing severity of the joint involvement.

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Interarticular Isthmus Hiatus (Spondylolysis)[1]

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ABNORMALITIES of the lumbar spine in respect to mechanical stability and functional capacity have been a matter of considerable importance to those concerned with industrial medicine. More recently they have assumed particular interest in the Armed Forces, for whom the correlation between structural variants of the spine and precipitation or development of "back pain" is a significant problem.

THE NORMAL VERTEBRA

Embryology (1, 9): At the second week of fetal life, there are two centers of chondrification in each vertebral body and one in each half of the incomplete neural arch. At the tenth week, the body shows a single center of ossification (at times two centers may appear). Concurrently, each half of the neural arch shows a single center of ossification. At birth, each lateral half of the neural arch consists of a bony plate united by cartilage with the body of the vertebra. During the first year of life, the vertebral arch forms as a result of fusion of these plates and gives rise to the spinous process. It is not, however, until the third year that the ossification of the neural arch and of the vertebral body becomes confluent. Full union of the primary centers is not completed until several years after birth.

Anatomy (7): The typical normal adult vertebra consists of two parts: an anterior segment, the body, and a posterior part, the vertebral or neural arch. These enclose the vertebral foramen. The vertebral arch consists of a pair of pedicles and a pair of laminae and supports seven processes: four articular, two transverse, and one spinous.

The pedicles are two short, thick processes which project backward, one on either side, from the upper part of the body, at the junction of its posterior and lateral surfaces. The laminae are two broad plates directed backward and medialward from the pedicles. The articular processes, two superior and two inferior, spring from the junctions of the pedicles and laminae.

Fig. 1. Anatomical specimen, oblique view, showing interarticular isthmus and site of hiatus (arrow).

In the vertebra which shows the type of lesion with which we are concerned (Fig. 1), there is an hiatus between the superior and inferior articular processes. To this region, when intact, the term "interarticular isthmus" has been applied (3). The dehiscence itself might well be called the "interarticular hiatus." Such a term would be more specific in localizing the site of the defect than the term spondylolysis ("dissolution of vertebra"), an inclusive term which, by common usage, has come to connote this separation of the articular processes. The word hiatus is also to be preferred to other terms such as defect, etc., which are not adequately descriptive of the exact finding. A defect is any imperfection, blemish, or fault, whereas an hiatus is defined as a gap or fissure, which is exactly what we find in this condition.

[1] Work performed while the authors were in the Medical Corps of the Army of the United States. Accepted for publication in July 1945.

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HISTORY

In 1853, Kilian (11) first described the entity of "spondylolisthesis," giving to it that name of Greek derivation meaning "slipping of a vertebra." Credit for its widespread recognition must be given to Neugebauer (20), who, in the last decade of the nineteenth century, became interested in the subject. At that time, spondylolisthesis was the particular property of the obstetrician, who had noticed that, on occasion, it was responsible for hard and prolonged labor.

With the advent of the roentgen ray, the entity soon became the concern of the orthopedic surgeon. As hiatuses in the interarticular isthmus were more frequently detected, the relationship to spondylolisthesis was suspected. The mechanism whereby the hiatus was produced was a matter of much speculation, but no acceptable explanation was offered.

ETIOLOGY

The original postulate of Neugebauer as to the cause of the hiatus in the interarticular isthmus was based upon the concept that the arch, instead of developing from two primary lateral centers of ossification, developed from four, one for each pedicle and superior articular process, and one for each lamina and inferior articular process. He felt that it was the failure of the latter to fuse with the former that resulted in a congenital hiatus. This idea was attributable to earlier anatomical studies (22) which have recently been discredited by Willis (23), Mall (15), Batts (2), and Hitchcock (9). In extensive series, these authors were unable to find embryological evidence to substantiate the theory of a congenital hiatus. No one has ever reported an embryo which showed double centers of chondrification or ossification in each lateral half of the neural arch.

Some authors are of the opinion that a pre-existing fault between the superior and inferior articular processes is present. This defect is thought to be bridged by fibrous tissue in the newborn or very young child. Then, when trauma in some form is applied to the spine, the fibrous tissue is ruptured. Subsequently, when healing takes place, they believe that callus will not form since cartilage rather than bone was present at the time of the injury. The existence of a congenital defect in the genesis of an hiatus is, however, not well supported by the evidence at hand.

Hitchcock (9), in a comprehensive report, offers some interesting experimental evidence from which the theory is derived that trauma applied in the form of hyperflexion during delivery or shortly afterward may be the cause. Carrying out an unstated number of experiments on stillborn children varying in age from eight months to term and on infant cadavers up to ten months postnatal, he was able to produce a typical fracture of the isthmus by hyperflexion of the spine. Usually the fractures were bilateral, but unilateral fractures could be produced by combining flexion with lateral bending and torsion. These fractures passed through the predominantly cartilaginous portion of the isthmus.

This work has much to offer of itself, and it is supported by other well recognized facts. It is known that a fracture through cartilage will not produce callus but will heal by means of a pseudarthrosis such as we sometimes find with an interarticular hiatus. The presence of smooth edges and cortical bone along the line of fissure, as well as the uniformity of the gap, indicates that the fracture occurred prior to complete ossification. The most convincing evidence as to the time of occurrence of the fracture is the fact that the fault is never seen in the fetus and that it has been produced experimentally after birth by hyperflexion of the spine. The earliest authenticated age at which an hiatus has been found roentgenologically is seventeen months (12).

TYPES AND SITES

An hiatus across the interarticular isthmus may occur as an isolated finding or be associated with extensive separation of

the segments. In the latter instance, the part bearing the lamina and inferior articular processes moves backward while the rest of the vertebra, consisting of the body, pedicles, superior and transverse processes, slips forward.

The interarticular hiatus may be unilateral or bilateral and can occur in one or more of the lumbar vertebrae, including a sixth if present. It has been reported in the first sacral segment (10). The hiatus is most commonly seen in the fifth lumbar vertebra (88 per cent). In our series we have seen it in the third, fourth, and fifth vertebrae. Slipping forward of the spinal column has been described as occurring at all levels of the lumbar spine. The dislocation usually occurs so that the involved vertebra carries forward with it the vertebral column above. Rare instances in which the vertebra below has slipped forward have been reported (14) as well as "reversed" or posterior slipping (18).

The extent of slippage has been arbitrarily classified by Meyerding (19) as first, second, third, and fourth degree, or total slipping, depending upon the relationship of the posterior (or anterior) margin of the body of the involved vertebra to the corresponding segment below it.

INCIDENCE

At an Army Air Forces Regional Hospital where 511 backs were examined during the period of one year because of "back pain," 52 (10.1 per cent) showed definite roentgenologic evidence of an interarticular hiatus. Nineteen (36 per cent) of the 52 cases showed associated slipping of varying degrees. These figures are somewhat higher than those in other reports, since only patients with symptoms were studied. In the series of 1,520 skeletons examined by Willis (23), the incidence of isthmus hiatus was found to be approximately 5 per cent. In 2,000 cases reported in the literature, isthmus hiatus was found to occur in slightly more than 5 per cent (4, 9). The high incidence of interarticular hiatus among Army personnel with complaints of "back pain" lays open the question of the significance of the interarticular hiatus in relation to spondylolisthesis and its correlation with the development of symptoms.

SIGNIFICANCE

The consensus of opinion is that an hiatus, as an isolated finding, is probably asymptomatic. The lack of symptoms does not, however, detract from its importance medically. Potentially, a vertebra with an isthmus hiatus may develop spondylolisthesis. This sequence of events has only recently been established. There are a few case reports in the literature with well substantiated evidence of progressive slipping (6, 9, 13). The specific factor in the development of spondylolisthesis is now thought to be trauma superimposed on the antecedent hiatus (9, 21). In 50 per cent of the cases, however, no history of trauma can be elicited. Whether the transformation occurs suddenly or slowly is uncertain. It has been suggested that a disturbance of the intervertebral cartilage plays a part in the dislocation of the vertebra. This concept has been touched upon in the past (8, 13, 16, 17); more recently, the role of thinning of the disk, as evidenced by x-ray, has been pointed out as a prominent feature (9).

Meyerding (17), in analyzing his series of 745 patients with spondylolisthesis, in the light of the newer knowledge concerning protruded intervertebral disk, found 80 who had symptoms of sciatica, and a much larger group who had vague pains and paresthesias of buttocks, hips, and thighs which might constitute a disk syndrome. He states that after he realized that a relationship might exist between an hiatus with slippage and disk protrusion, the incidence of a double diagnosis has increased considerably. In 15 out of 25 cases of spondylolisthesis associated with sciatica, the additional diagnosis of protruded disk was made. Six of the 15 patients were operated upon, and the diagnosis was confirmed (17). Recently Dandy (5) expressed the opinion that the symptoms of spondylolisthesis and defective

Fig. 2. Lateral view: isthmus hiatus of third lumbar vertebra.

Fig. 3. Anteroposterior view: bilateral isthmus hiatus of fourth lumbar vertebra.

intervertebral disks are precisely identical and that the treatment is the same: *i.e.*, complete removal of the disk.

Whether there is a concomitant, precipitating, or sequential relationship is an interesting but merely speculative concept. On the basis of these reports, it is postulated that the presence of an isthmus hiatus provides an unstable spinal column which leads to injury of the disk. When degeneration of the disk takes place, the nucleus pulposus may protrude posteriorly, or shrinkage and subsequent decrease in the intervertebral space may permit slippage. The typical syndrome of back and leg pain associated with a protruded intervertebral disk or spondylolisthesis, or both, may be brought about. In the light of these possibilities the presence of a simple isthmus hiatus deserves more serious consideration than it has received in the past.

ROENTGEN FINDINGS

The conclusive finding is the demonstration by roentgenography of the hiatus itself. This is best demonstrated in the lateral (Fig. 2) or oblique view (Fig. 4) of the spine, whereby the isthmus is brought out in profile. Close inspection of a routine anteroposterior view (Fig. 3) of the spine often offers sufficient evidence to warrant the diagnosis.

A suggestive sign is the underdevelopment or posterior wedging (Figs. 5 and 6)

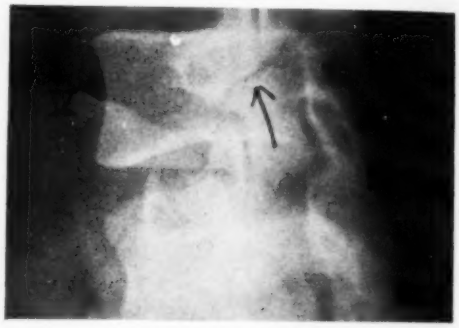

Fig. 4. Oblique view: isthmus hiatus of fourth lumbar vertebra.

of the body of the involved vertebra so that its height is less than that of the adjacent segments. Normally the vertebrae should become progressively larger as they near the sacrum.

Slippage in association with an hiatus is manifested by displacement of the affected vertebral body (Figs. 5 and 6). This is demonstrated by the abnormal relationship of its posterior margin to that of the segment below it. Normally, a line drawn along the posterior margin of the lumbar bodies should be continuous with one along the posterior margins of the sacral bodies.

Further evidence is an abnormal increase in the anteroposterior diameter of the involved vertebra as compared to adjacent vertebrae (Fig. 5). This diameter is measured from the tip of the spinous

process to the anterior border of the vertebral body. The increased value is due to backward displacement of the posterior segment (spinous process and inferior articular processes) or anterior displacement of the anterior segment (body, superior articular and transverse processes) of the affected vertebra, or both.

Additional evidence, occurring only in long-standing cases and probably nature's response in an attempt to prevent complete slippage, is the piling up of bone at the anterior lip of the sacrum, forming a buttress or ledge for a slipped fifth lumbar vertebra to rest upon (Fig. 6).

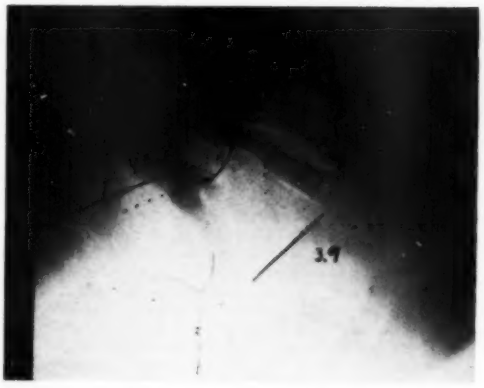

Fig. 6. Lateral view, illustrating slipping, buttress formation, and underdevelopment as evidenced by posterior wedging and decrease in size of involved vertebra.

Fig. 5. Lateral view: underdevelopment, first-stage slipping, and increased total anteroposterior diameter of involved vertebra.

CONCLUSION

Although the evolutionary process of man is evidenced by anomalies of the lumbar spine, the vertebral interarticular isthmus hiatus (spondylolysis) does not fall into that category. It is probably the result of a hyperflexion injury or fracture through the cartilaginous isthmus sustained either at birth or shortly thereafter.

In a series of 511 backs examined because of the complaint of "back pain," 10.1 per cent showed an isthmus hiatus. Nineteen had associated slipping of the vertebra.

The postulate is offered that the presence of an hiatus affords an unstable state which may lead to degeneration of the intervertebral disk. When this occurs, either slipping of a vertebra or protrusion of the disk takes place. This leads to the typical clinical syndrome seen with either a protruded intervertebral disk or spondylolisthesis. The detection of a simple hiatus, therefore, deserves serious consideration.

The diagnosis of interarticular hiatus with or without slipping is based upon the roentgen findings, of which there are five:

1. Demonstration of the hiatus.
2. Underdevelopment of the vertebral body.
3. Displacement of the vertebra in relation to adjacent segments.
4. Increased total anteroposterior diameter of the vertebra.
5. Buttress formation at the anterior lip of the sacrum when the fifth lumbar vertebra slips.

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The Treatment of Carcinoma of the Cervix[1]

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THE PAINSTAKING work of a few European and American institutions during the 1920's established the fact that the methodic and skillful use of radium in the treatment of carcinoma of the cervix yielded an appreciable percentage of five-year survivals in the operable as well as in the inoperable group (8). The use of radium in the treatment of early carcinoma of the cervix found rapid acceptance as the method of choice among gynecologists, radiotherapists, and surgeons. This was mainly due to the fact that, besides its effectiveness, intracavitary radium therapy could be practised with little risk according to standardized technics and also because the Wertheim operation even in the most skilled hands offered too high an operative mortality. In the treatment of the inoperable group of cases, by far the largest and most important, radiotherapy was early recognized as the only means of approach.

Obviously the results which have been subsequently obtained with varying technic and varied skills have not been at the high level of those which conquered for radiotherapy its predominant place in the treatment of this disease.

STAGE I

The Subcommittee on Radiotherapy of Cancer (Regaud, Heyman) of the League of Nations contributed a classification of carcinoma of the cervix in four stages which, as it stands after modification in 1937, constitutes our best present means of establishing a prognosis in this disease. According to this classification, now almost uniformly adopted, *only about 10 per cent of all cases of carcinoma of the cervix belong in Stage I.* That is, only 10 patients of every 100 present themselves with the disease confined to the cervix, without invasion of the fornices, corpus, or parametria (Table I).

TABLE I: CARCINOMA OF CERVIX: PROPORTION OF CASES IN DIFFERENT STAGES*

(Report of Subcommittee on Radiotherapy of Cancer, League of Nations)

Stage I	607 cases	(11%)
Stage II	1,625 cases	(29%)
Stage III	2,417 cases	(42%)
Stage IV	1,020 cases	(18%)†

* 5,669 cases reported by nine institutions; 898 other cases, neither treated nor staged, mostly advanced cases, are not included.

† Classification of 1929, before its revision in 1937. The revision does not affect the proportion of Stage I cases. It will probably increase the number of cases in Stage II and reduce the proportion of Stage IV.

Recent advances in anesthesia and better knowledge of shock have justified a rebirth of enthusiasm for the surgical treatment of these Stage I cases. A marked reduction in operative mortality would become a very powerful argument in favor of surgery. Meigs reports a very low operative mortality but points to the unexpected high incidence (10 per cent) of injury to the ureter (7).

The occurrence of bowel necrosis has been mentioned as an unfavorable aspect of radiation treatment. Such complications do occur, but they are an exceptional, not necessarily fatal, untoward effect. These accidents vary greatly according to the technic. They occur most often after treatment of patients in advanced stages receiving a maximum of external and internal radiation. In such advanced cases the necrosis of the bowel usually accompanies a recurrence with pelvic infection and inflammation, which contribute as much to the necrosis as the radiation itself. In the treatment of the early cases, such accidents are avoidable through proper conduct of the treatment.

[1] Edited from a lecture delivered at the Barnard Skin and Cancer Hospital, St. Louis, Mo., Feb. 26, 1945. Accepted for publication in July 1945.

In more advanced cases they constitute a negligible risk.

Also, in support of the surgical treatment, it has been often said that cases clinically classified as Stage I may already have unsuspected pelvic metastases. The implication is that in such cases radiotherapy will fail and that surgery offers a chance. The percentage of Stage I cases which show metastases on pathological examination of the surgical specimens has been put rather high. Some authors have reported a strange adenoid arrangement of these "metastatic" cells (6). Actually such ring-like epithelial structures are found frequently in the pelvic nodes of normal women. They are in all probability fragments of normal endometrium which have been transported through the lymphatics in a true metastatic fashion, but they are unquestionably benign in nature (3). On a thorough pelvic examination, some cases of apparently early carcinoma of the cervix, without invasion of fornices or parametria, are found to have isolated pelvic metastases palpable against the pelvic wall. The League of Nations classification provides for the classification of such cases as Stage III. These metastases may be microscopic or beyond the reach of the palpating finger. When these early metastases occur, we are usually in the presence of a rather undifferentiated carcinoma, very radiosensitive, and biologically unfavorable to surgical treatment. The chances of success of the surgical treatment of carcinoma of the cervix rely on the possibility of complete removal of the tumor when this is strictly confined to the cervix. The additional removal of isolated nodes is a very unsatisfactory procedure, to say the least. *The occurrence of metastases in a small group of Stage I cases is, at best, an argument in favor of thorough external and internal irradiation, even in early cases.*

In 1938 the Subcommittee on Radiotherapy of Cancer, named above, reported the compiled statistics of results from nine institutions of Belgium, England, France, Sweden, and the United States (4). These statistics represent an average of the poor results of early experimental years (1914) and better ones obtained through perfected technics (up to 1931). They are also an average of results of the different technics and the different quality of work in these several institutions. The compilation shows that the treatment of several hundred Stage I cases resulted in 55 per cent five-year survivals (Table II).

TABLE II: RESULTS OF RADIOTHERAPY IN 5,669 CASES OF CARCINOMA OF THE CERVIX TREATED IN NINE DIFFERENT INSTITUTIONS, FROM 1914 TO 1931

(Report of Subcommittee on Radiotherapy of Cancer, League of Nations)

	Cases*	Well 5 years†
Stage I	607	335 (55%)
Stage II	1,625	590 (36%)
Stage III	2,417	512 (21%)
Stage IV	1,020	52 (5%)

* Cases incompletely treated are included.

† Patients dead of intercurrent disease before five years were considered as failures.

It is unquestionable that the Wertheim operation, in skilled hands, yields a high percentage of five-year survivals. The disadvantages have been its operative mortality and morbidity. At the Barnard Skin and Cancer Hospital, 41 cases of carcinoma of the cervix, Stage I, were operated upon from 1928 to 1938. Thirty-three of the patients (80 per cent) remained free of disease five years after the operation. The operative mortality was 14 per cent. Only those cases which could not be operated upon because of obesity, hypertension, diabetes, cardiorenal disease, etc., were treated with radiations. The five-year survival in this last group of 27 patients was 60 per cent, a very good result considering the human material used (2).

But if isolated surgical statistics from outstanding centers compare favorably with the over-all average of results of radiotherapy, so also do the small series of results of radiotherapy in outstanding radiotherapeutic centers. Regaud (9) reported 28 cases cured (75.6 per cent) out of 37 Stage I cases treated from 1925 to 1929. Hurdon (5) reported 32 cures (80

per cent) in a group of 40 cases treated from 1934 to 1937. These two workers, incidentally, treated their Stage I cases with intracavitary radium therapy alone, without external irradiation.

STAGE II

When the carcinoma has extended beyond the cervix proper to the fundus, vaginal walls, or parametria, the chances of success of a surgical excision are greatly reduced. In most cases the operation would not be practicable. In the small number in which a Wertheim operation is technically possible, the operative mortality, the postoperative complications, and the chances of recurrence are considerably greater than in earlier cases.

The radiation treatment of Stage II cases carries few added difficulties. It must not be forgotten, however, that a Stage II tumor may be quite voluminous. Theoretically, a carcinoma of the cervix may have extended to the uterine fundus, infiltrated both parametria almost to the pelvic wall, and invaded the upper two-thirds of the vaginal tube, and still remain within the definition of Stage II. Intracavitary radium therapy alone may be successful in some of these cases, but the percentage of favorable results is increased when thorough external pelvic roentgen therapy has preceded the internal treatment. Regaud reported the comparative results of intracavitary radium therapy alone and in association with x-ray therapy (9). The five-year survivals in Stage II were 31 per cent and 46 per cent, respectively (Table III). The over-all average of results of radiotherapy in this stage as compiled by the League of Nations was 36 per cent five-year survivals.

Attempts have been made to combine radiation and surgical treatment in Stage II cases. Leveuf, Herrenschmidt and Godard (6) advocated a dissection of the "principal" chain of lymphatics of the cervix. This is, by no means, a complete dissection of all lymphatics and their corresponding nodes. Taussig (10) applied this operation, which he called *iliac lymphadenectomy*, to the treatment of Stage II cases after external irradiation had been completed and before intracavitary radium therapy was instituted. Of 70 cases so treated, 46 had no node metastases. All that can be said is that in these 46 cases the operation was useless. Of the 24 cases which showed node involvement, only 5 (21 per cent) remained well at the end of five years. Such an elaborate combination of treatments would not be justified unless it raised the percentage of good results substantially. Actually, the percentage of five-year survivals (38 per cent) obtained by Taussig in the entire group compares unfavorably with the results in cases treated with radiation alone in other clinics, and is practically the same as the over-all average results of radiotherapy mentioned above.

TABLE III: VALUE OF EXTERNAL PELVIC ROENTGEN THERAPY

(Radium Institute, University of Paris—Regaud)

	Intracavitary Radium Therapy Alone (1919–29)		External Roentgen Therapy plus Radium Therapy (1926–30)	
	Cases	Well 5 years	Cases	Well 5 years
Stage II	175	54 (31%)	217	100 (46%)
Stage III	133	10 (7%)	226	77 (34%)
Stage IV	...	.....	24	2 (8%)

STAGE III

When the carcinoma has invaded the pelvic wall on one or both sides, or the lower third of the vagina has been reached, the case is an extensive one. The percentage of cures, however, may be surprisingly high. To attempt to cure these cases with intracavitary radium therapy alone is to hope for the miraculous. To add inadequate external irradiation to the procedure changes the form but not the result. *If internal irradiation can be called the most important single factor in the treatment of early cases, a thorough external roentgen therapy is the most important single factor in the treatment of advanced cases.*

Baclesse (1) reported a series of 45 cases of advanced carcinoma of the cervix in Stages III and IV which received external

pelvic roentgen therapy alone. No internal treatment was given. Seven patients (15 per cent) remained free of disease at the end of five years. These patients received a very thorough external irradiation and obviously would have had a better chance if the treatment had been completed by internal irradiation. The series proves that external roentgen therapy is a powerful agent when judiciously used.

It is not our purpose to discuss here the details of technics of treatment. It suffices to say that in view of the attainable results there is ample place for serious consideration and improvement of present technics of external pelvic irradiation. The routine, inadequate, and insufficient external roentgen therapy which, too often, is given to these patients is a product of the lack of comprehension of the great possibilities of roentgen therapy in this group of cases. What is called a "frozen pelvis," with the stigma of incurability that hangs on it, is usually a curable Stage III carcinoma of the cervix. It is not generally realized that *a Stage III carcinoma of the cervix, competently treated, has a better prognosis than an operable carcinoma of the stomach.* The over-all average of five-year survivals as compiled by the League of Nations is 21 per cent for Stage III. Through better use of external pelvic roentgen therapy, the average clinic can improve its results in Stage II and Stage III cases. The improvement in the treatment of these two stages, which constitute three-fourths of all carcinomas of the cervix, may mean an additional salvage of between 15 and 20 cases in every 100, of all stages, receiving treatment. As a comparison, one may consider that in the treatment of Stage I cases a five-year survival of 80 per cent as compared with one of 60 per cent means only an additional salvage of 2 patients in every hundred cases of carcinoma of the cervix, of all stages, receiving treatment.

STAGE IV

When carcinoma of the cervix has invaded the rectum or bladder or extended above or below the limits of the pelvis, the case is very serious indeed, but still not hopeless. Through painstaking effort a small number of these patients can be cured. Bladder invasion may occur rather early in the chronological development of carcinoma of the cervix. Patients have been cured in whom perforation into the bladder mucosa had already occurred.

In the treatment of Stage IV cases, the external pelvic irradiation will bear the burden of the effort and will be responsible for the results. Unquestionably, the large amount of care which is necessary will yield in the majority of cases only a transient palliation. The majority of patients will expire within a few weeks after the treatment, a few will survive for some months, but the small percentage of cases that will be permanently controlled makes the effort worth while.

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Some Experiences with Priodax[1]

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PRIODAX OR β-(4-hydroxy-3,5 diiodophenyl)-α-phenyl propionic acid, became available for use in our hospital in May 1944. Prior to that date, various reports (1–6, 8) had appeared which led to the belief that the use of this new contrast medium was accompanied by no unpleasant symptoms, or at most by symptoms which were negligible. It was therefore decided to interview and record the reactions of the first 250 patients to receive Priodax for gallbladder examination and at the same time to study its efficacy for cholecystography.

The preparation of the patient was exactly the same as had previously been practised with sodium iodophthalein. The usual lunch was given on the day before the examination. The evening meal was fat-free. One hour after the meal, six Priodax tablets were given according to the instructions on the containers (1 tablet every five minutes, with a sip of water or fruit juice). The patient was permitted no breakfast on the following morning except black coffee or plain tea. He received a cleansing tapwater enema at 7 A.M., and the x-ray examination was done at 8 A.M. The single-dose method (6 tablets) was used throughout the series of 250 unselected cases.

After the completion of the x-ray examination, the patient was asked the following questions: "Did the tablets you took last night make you sick in any way?", "Did you become nauseated?", "Did you vomit?" Patients often volunteered the information that they had pains, cramps, dizziness, or headaches. They were then asked: "Did you notice anything unusual when you passed your water last night or this morning?", "Were your bowels affected in any way?", "Have you had your gallbladder x-rayed before?" If the answer to this last question was in the affirmative, the patient was questioned as to what substance was used for the earlier examination, and whether it had made him sick or had upset him in any way. He was then asked which substance he would prefer to take if another examination should be required. The answers were recorded in tabular form with the radiographic results and, whenever possible, the results were compared with the answers given to questions relative to the examinations with iodophthalein.

Some of the observations are given in summary in the accompanying table, along with results obtained by other authors. It is obvious that the symptoms recorded are entirely subjective and that the degree of severity, as claimed by the patients, cannot be accurately compared. No effort is made, therefore, to grade the reactions into categories other than "severe" and "not severe." Nausea and dysuria were considered severe only when the patient voluntarily offered the information as such. Diarrhea varied from a loose bowel movement to eight watery movements. Three or more watery movements were considered a severe diarrhea.

Of the 250 patients, 23 per cent complained of nausea of varying degree, approximately 1 per cent vomited, and 43 per cent had loose bowel movements or diarrhea. Dysuria was experienced by 50 per cent of the patients, and 16 per cent had other symptoms, as pain, dizziness, headache, or a choking sensation. None complained of burning sensations in the throat. The outstanding difference in the results of this series of examinations, as compared to those previously reported, is the higher incidence of diarrhea and dysuria. Most of the previous reports record loose bowel movements or diarrhea in less than 23 per cent of those examined. No previous report has recorded dysuria as occurring in more than 20 per cent of the

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CASES SHOWING SIDE EFFECTS FROM USE OF PRIODAX AS REPORTED BY VARIOUS AUTHORS

Author	No. of Cases	No Symptoms	Nausea	Vomiting	Diarrhea	Dysuria	Pain	Comments by Authors
Bryan and Pedersen (1)	845	*	20%	2%	30%	12%	12%	.....
Dannenberg (2)	143	*	17%	3%	23%	17%	2%	"The major advantage of Priodax is the avoidance of any laxative action"
Hefke (3)	600	*	8%	1%	11%	3%	*	"Nausea, vomiting, and diarrhea are much less frequent than with tetraiodophenolphthalein"
Marshall (4)	50	*	0	2%	2%	4%	0	"It (Priodax) does not act as a purgative"
Ochsner (5)	300	56%	26%	3%	15%	5%	9%	.....
Paul, Pohle, and Benson (6)	114	*	28%	2%	23%	15%	*	"Burning on urination was of little consequence"
Vaughan and Eichwald (7)	163	19%	2%	*	5%	5%	*	"Diarrhea, nausea, and vomiting were infrequent"
Wasch (8)	134	32%	18%	0	13%	20%	7%	"Reactions have been negligible"
Present Study	250	14%	23%	1%	43%	50%	16%	"6% had severe nausea; 10% had severe diarrhea; 25% had severe dysuria"

* Not recorded.

patients; it was present in severe form in 25 per cent of the patients in this series, and in milder form in an equal number.

Whereas other authors (5) have reported no symptoms in as many as 56 per cent of their patients, in only 14 per cent of this series was there a complete absence of symptoms following the administration of Priodax. Of the 34 patients, however, who had both Priodax and iodophthalein cholecystography, 30 (90 per cent) expressed a preference for Priodax because of the ease with which it could be taken by mouth. Only one patient expressed a preference for iodophthalein, and three expressed no choice. In 14 of these 34 cases, films were available for comparison of the radiographic results. The results with Priodax were superior in 8 cases, equal in 5, and inferior in 1 instance. In 2 of the cases in which the results with Priodax were superior, the patients were unable to retain iodophthalein taken by mouth.

In this series of 250 cases, the gallbladder was well visualized in 89 per cent, faintly in 5 per cent, and not at all in 6 per cent. Cholecystectomy was performed in 6 of the 250 cases. In 4 of these cases, the gallbladders were visualized and contained non-opaque calculi; in 2, the gallbladders were not visualized but calculi were demonstrated in the region of the cystic duct. In each instance, the operative findings confirmed the radiographic diagnosis.

From the radiographic standpoint, there were found to be two definite advantages in using Priodax. One is the lack of opaque material in the colon, which may obscure a part of the gallbladder, as in examinations done with iodophthalein. Another was the infrequency of faintly visualized gallbladders which required additional radiographic study.

SUMMARY

In 250 examinations of the gallbladder, Priodax was found to be a satisfactory medium. It was more palatable than iodophthalein. Unlike iodophthalein, it rarely appeared in the colon and, therefore, rarely masked the gallbladder. The density of the shadow produced by Priodax was greater than that produced by iodophthalein, so that faint visualization was infrequent. The symptoms produced by the administration of Priodax, however, were not as negligible as previous reports indicated.

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Pancreatic Calculi as a Rare Cause of Intestinal Hemorrhage

Report of a Case[1]

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THE PURPOSE OF this communication is to call attention to the fact that calculi of the pancreas can cause a fistula leading into the duodenum and result in the formation of a chronic peptic ulcer of the second portion. This ulceration may cause severe bleeding from the gastro-intestinal tract.

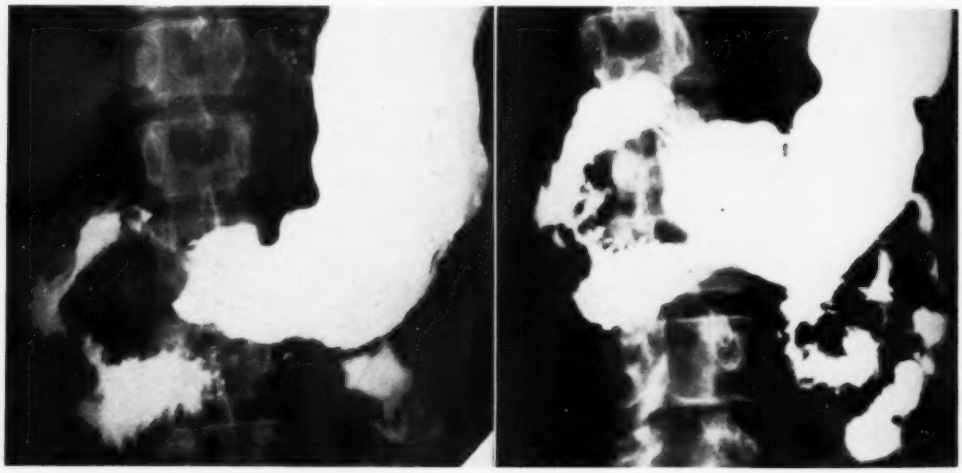

Fig. 1 (left). Barium meal examination of upper gastro-intestinal tract made in September 1944, showing a filling defect of the second portion of the duodenum at its junction with the third portion. Note the calcific spherical density medial to the duodenal loop.
Fig. 2 (right). Roentgenogram of upper gastro-intestinal tract made in January 1945, again showing filling defect of the second portion of the duodenum with a small ulcer crater at the upper aspect of the defect.

Fanger (1) recently reported a case in which a pancreatic calculus eroded an artery in the region of the second part of the duodenum and caused a fatal hemorrhage into the bowel. In the case to be reported, pancreatic calculi eroded into the duodenum and produced a chronic peptic ulcer, which on several occasions caused massive hemorrhages. It would therefore appear that pancreatic calculi must be included in the differential diagnosis of bleeding from the gastro-intestinal tract.

CASE REPORT

M. W. F., a 35-year-old man, had suffered attacks of diffuse upper abdominal pain for the past eighteen months. The pain had no relation to meals, was never agonizing, did not radiate, and was only occasionally associated with vomiting. Three months before admission the patient had two massive hemorrhages from the gastro-intestinal tract, with vomiting of blood and melena. Following this he was very weak and a blood transfusion was given. Except for the melena following the hemorrhage, there had been no abnormality of the stools. There had been a loss of 35 lb. in weight in fourteen months. The remainder of the history was noncontributory.

On admission to the U. S. Naval Hospital, San Diego, physical examination revealed no abnormalities. Routine laboratory studies showed a slight secondary anemia with 3,570,000 red cells and 75 per cent hemoglobin. Urinalysis on one occasion showed sugar, but there was none in subsequent specimens. The blood sugar was 130 mg. per cent.

Oral cholecystography showed a normally functioning gallbladder. Fluoroscopic and radiographic examination of the esophagus and stomach was

[1] Accepted for publication in July 1945.

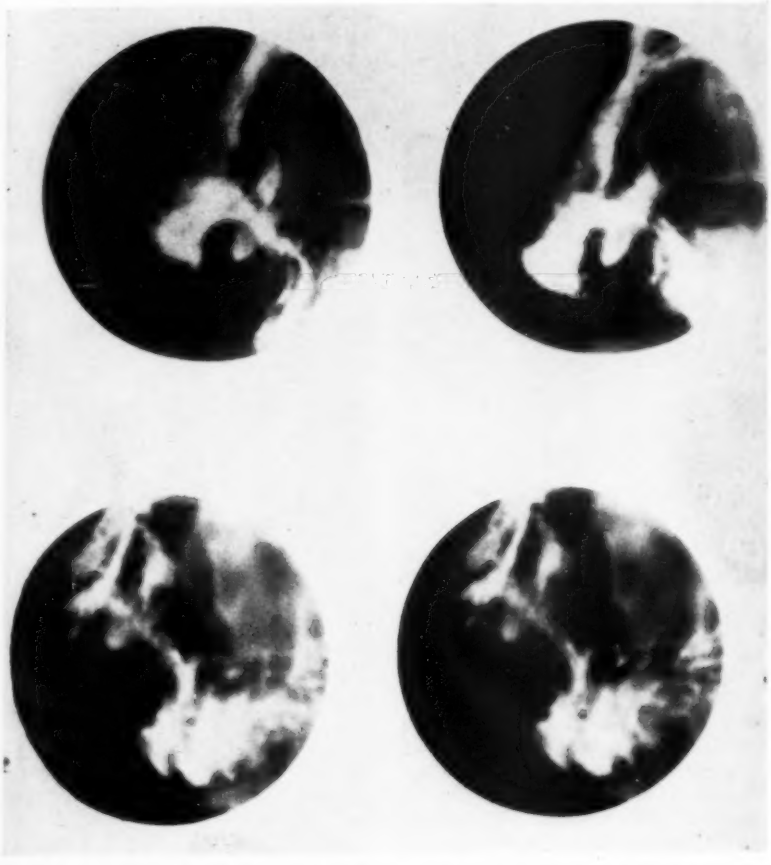

Fig. 3. Spot films of second portion of duodenum, showing defect on lateral side, with small ulcer crater at upper aspect of the defect.

negative, and the duodenal bulb was normal. A constant semilunar filling defect was observed on the right side of the duodenum proximal to the junction of its second and third portions. This defect measured 1.5 × 3 cm. and was smooth in outline except that at its upper aspect a small ulcer crater measuring about 4 × 10 mm. was found. The findings were interpreted as being consistent with a non-obstructing ulcerated benign tumor in the duodenum, apparently intrinsic and located at the junction of the second and third portions (Figs. 1, 2, and 3).

An additional finding was the presence of a radiopaque spherical shadow measuring about 1 cm. in diameter at the level of the inferior portion of the first lumbar vertebra on the right side. This shadow was definitely outside of the gallbladder and was not in the stomach or duodenum. It was interpreted as a pancreatic calculus or a calcified mesenteric lymph node (Fig. 4). A preoperative diagnosis of benign tumor of the duodenum, possibly a myoma with ulceration, was made and operation was advised.

Through a right rectus incision, the upper abdomen was explored. There was a thickening of the wall of the second portion of the duodenum, most marked in its lower posterolateral portion. The entire pancreas was tense and swollen and its head was hard and enlarged to about twice the normal size. The second part of the duodenum was opened transversely at its mid-point and the interior explored. The ampulla of Vater was found and, by compression of the gallbladder, the common bile duct was proved to be patent. About 1.5 cm. lateral to the ampulla was a punched-out, chronic peptic ulcer penetrating all coats of the bowel except the serosa. The base of this ulcer was white and scarred. The incision in the anterior wall of the duodenum was extended laterally to allow excision of the ulcer. After the ulcer was excised, a fistulous tract or a duct was found extending medially from the ulcer site. A probe inserted in this tract en-

Fig. 4. Oral cholecystogram showing normal concentration of dye in the gallbladder. A spherical shadow of calcific density is seen to the right of the first and second lumbar vertebrae.

countered calculi. With some difficulty these were grasped with curved forceps and removed in small fragments. They were multiple and crumbled like old plaster (Fig. 6). After removal of the main mass of calculi there was a rush of pancreatic juice and flocculent material, indicating that the pancreatic duct had been completely occluded. All palpable calculi were removed and a probe could then be inserted as far as the tail of the pancreas. A catheter was inserted into the pancreatic duct to prevent its occlusion by sutures during the closure of the duodenum. This catheter was removed before the last few sutures were taken in the anterior duodenal wall. The abdomen was closed without drainage.

Convalescence was uneventful except for the development of a minimal infection of the wound. The abdominal pain present before operation did not recur, and the patient made an uncomplicated recovery and was returned to duty.

A roentgenogram made three weeks after the operation showed incomplete filling of the right side of the second portion of the duodenum which corresponded to the site of surgical excision of the ulcer and repair of the duodenum. A small streak of barium was seen to enter the pancreatic duct. The large calculus to the right of the first lumbar vertebra, previously described, was no longer seen. There was no evidence of obstruction (Fig. 5).

The pathologist reported that the tissue excised from the duodenum showed chronic inflammation with ulceration and no evidence of malignant change. Analysis of the calculi showed them to be composed of calcium.

DISCUSSION

Although it is entirely possible that in this case the pancreatic duct opened separately into the duodenum 1.5 cm. medial to the ampulla of Vater, the chronic ulcer and the appearance of the tract leading to the

Fig. 5. Postoperative barium study of the upper gastro-intestinal tract, showing irregularity of the lateral margin of the second portion of the duodenum at the site of excision of the benign peptic ulcer. Note the small streak of barium extending into the pancreatic duct at the site of the removed calculus.

stones made it appear that this tract represented a fistula arising from the stones and extending into the duodenum. Such fistulae from pancreatic stones have been reported by Fanger (1) and Case (2), and in at least one instance the stones have been discharged through the abdominal wall. A second possibility is that occlusion of the pancreatic duct so diminished the alkali in the duodenum that the acid of the stomach was not neutralized and a peptic ulceration resulted. This possibility was demonstrated by Mann when he trans-

planted the pancreatic and bile ducts of dogs to the jejunum. However, the fact that the fistula led from the base of the ulcer to the stones makes it seem more likely that it originated at the site of the stones, penetrated the duodenum, and was converted to a chronic peptic ulcer by the action of the digestive juices. Erosion of a vessel was doubtless responsible for the hemorrhages.

Fig. 6. Roentgenogram of the fragmented pancreatic calculus after removal.

SUMMARY

1. A case in which pancreatic calculi formed a fistula leading into the second portion of the duodenum is reported.

2. The mouth of this fistula had the appearance of a chronic peptic ulcer.

3. On several occasions massive hemorrhage occurred, presumably from the ulcer or from the fistulous tract.

4. Pancreatic calculi should be considered as a rare cause of bleeding from the upper gastro-intestinal tract.

5. Radiographically a benign ulcer of the second portion of the duodenum may produce a deformity simulating a benign tumor with ulceration.

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Roentgen Demonstration of a Benign Intramural Tumor (Fibromyoma) on the Greater Curvature of the Stomach[1]

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THE MORE COMMONLY encountered lesions on the greater curvature of the stomach are carcinomata and benign and malignant ulcers. The appearance of these lesions is well known to the roentgenologist. The roentgen demonstration of a benign neoplasm on the greater curvature of the stomach is less familiar. The incidence of benign neoplasms among all the gastric tumors varies between 1.3 per cent and 25 per cent according to surgical or postmortem studies. Among the benign neoplasms found on the greater curvature of the stomach, the leiomyomata are predominant, constituting 10 per cent of all benign gastric lesions. Reported instances of myomata on the greater curvature, with correlation of the roentgen and pathologic findings are few. The reason lies possibly in the fact that benign tumors of the stomach seldom give rise to sufficient symptoms to warrant careful roentgen examination or operation. In the case to be reported, the neoplasm was associated with gastric ulceration on the lesser curvature of the stomach. The symptoms produced by the gastric ulcer led to thorough roentgenologic investigation and subsequently to abdominal exploration.

REPORT OF CASE

The patient was a Norwegian seaman, aged 61 years. Aside from an acute neisserian infection at the age of 20 years, he had enjoyed good health up to about ten months before admission to hospital. Since that time he had suffered from intermittent abdominal distress, occurring after the ingestion of heavy food, particularly after dinner, and relieved by bicarbonate of soda or tincture of opium. The distress was described as a gnawing ache. Occasionally there occurred a more severe stabbing pain, radiating from around the anterior-superior iliac spine on both sides up to both costal margins and across the upper part of the abdomen. There was no radiation of pain to the back. During certain periods the patient had frequent attacks of vomiting, but at no time was there any indication of hematemesis or melena. While ashore, and having access to milk and a lighter diet, he would feel better. His appetite throughout had been poor, and he had lost weight, from a normal of 76 kg. (167 lb.) to 56 kg. (123 lb.) at the time of admission. He had also noticed a pronounced loss of strength, having to rest frequently during regular tasks, which he had previously executed without any particular physical exertion. He had likewise been impressed by an increasing intolerance to heat in the engine room, by profuse perspiration, and by a certain tremor of the hands which made it difficult for him to write letters or perform finer manual tasks.

General Examination: The patient, who was found to be of the quiet, unassuming type, appeared chronically ill. The systolic blood pressure was 130 mm. Hg and the diastolic 90 mm. Hg. The heart action was rhythmic, 92 per minute. There was a fine tremor of the fingers and tongue. Peripheral arteriosclerosis of moderate degree was also noted. The skin was dry. The thyroid gland was not enlarged and there were no thyrotoxic eye symptoms. Careful abdominal examination revealed nothing of importance except slight tenderness to deep pressure in the mid-epigastrium. The physical examination otherwise was essentially negative.

Laboratory examinations revealed a normal urine, normal values for hemoglobin and number of leukocytes and erythrocytes. Extensive studies of the blood chemistry showed no abnormalities except the value for plasma cholesterol, which amounted to 330 mg. per cent. The fasting blood sugar was found to be 110 mg. per cent, and the values one, two, and three hours after the ingestion of the glucose for a routine tolerance test were 95, 89, and 70 mg. per cent, respectively. Following ingestion of the glucose solution, the patient perspired freely and there was tiredness indicative of a mild hypoglycemic reaction.

The gastric secretions indicated no free hydrochloric acid in the fasting specimen. Following a routine test meal, the acidity values increased to a maximum of 19 for free hydrochloric acid and 33 for

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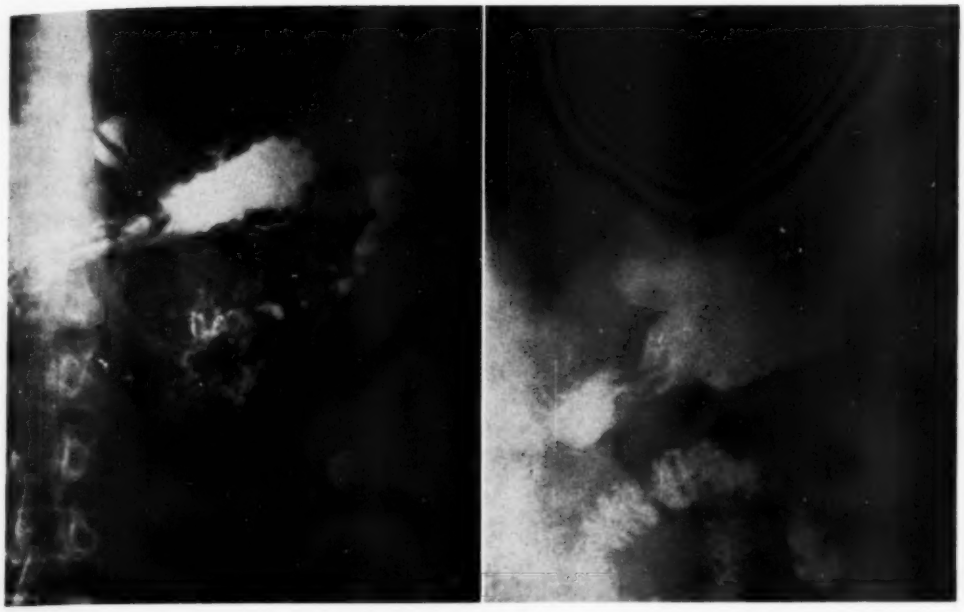

Fig. 1. Routine prone mucosal view and oblique view of the stomach filled with barium, which fail to disclose any definite abnormalities.

Fig. 2. Mucosal view with minimal rotation in the right oblique, showing accumulation of barium in an area devoid of serrations. The same projection with filled-organ technic shows the contraction of the entire involved area.

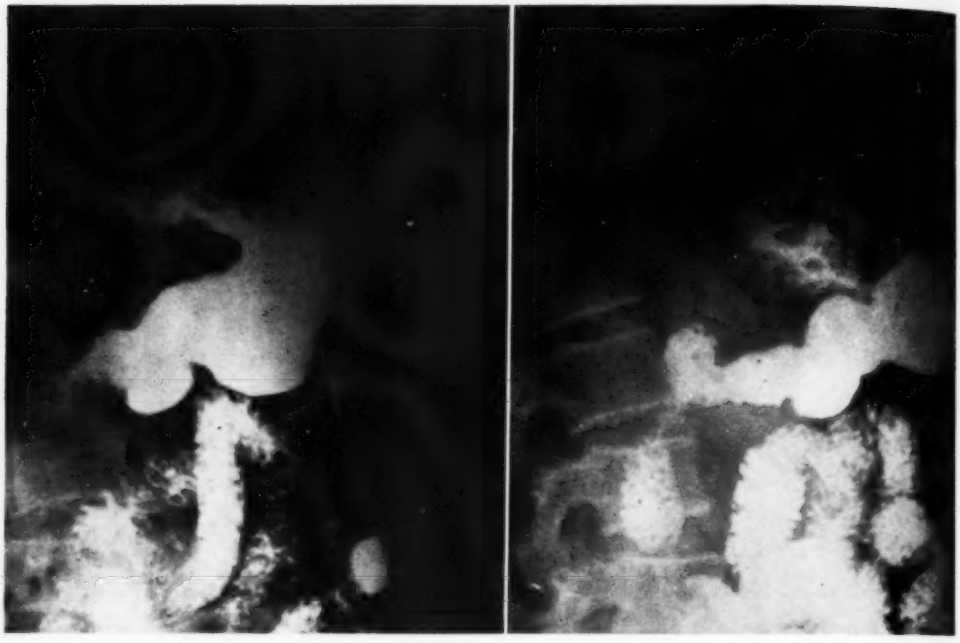

Fig. 3. Erect oblique and erect lateral studies showing the absence of serrations in the involved area.

total gastric acidity after thirty minutes. Repeated examinations of the stool for occult blood proved negative. The basal metabolic rate was −20. The Wassermann reaction was negative.

We shall not discuss the various differential diagnostic problems which presented themselves. Suffice it to state that the patient was placed on a milk diet, to which were gradually added lighter digestible foods as his well-being improved. He was likewise given thyroid medication. Finally, he was dismissed, greatly improved, to a convalescent home June 19, 1944.

In view of the well known fact that a patient past sixty years of age might well be harboring a gastric carcinoma in spite of a satisfactory improvement in his general condition on a medical regimen, a return for an exploratory laparotomy was advised, should symptoms recur.

On Nov. 16, 1944, the patient was readmitted. He had felt very well up to about seven weeks before his return, when there had been recurrence of abdominal symptoms identical with those previously experienced. During the last two weeks before admission, however, there was radiation of pain to the back and frequent attacks of vomiting had occurred, although there were no indications of gastro-intestinal hemorrhage.

The x-ray study (Lewitan) prior to admission had shown a loss of normal serrations on the greater curvature of the stomach in an area measuring about 4 cm. This area was separated by smooth margins from the remaining part of the greater curvature of the stomach, which appeared normal. This finding was constant, but could be obtained only on minimal rotation in the right oblique projection. On the prone mucosal studies no abnormalities were noted. Lateral views and other oblique views also failed to present any abnormal findings. In the 15-degree oblique projection, using the filled-organ technic, one could see the entire involved area contract as a whole. The indentations proximal and distal to the involved portions of the stomach were very deep and an incisura effect was thus produced. In the erect position, a semicircular area opposite the incisura angularis was noted, corresponding in size to the lesion as demonstrated on the mucosal studies. The roentgen appearance was rather bizarre. It was felt, however, that a benign ulceration or a benign tumor was the most likely diagnosis.

The findings on physical examination at this admission did not differ essentially from those at the first admission, except for a pronounced tenderness to direct pressure over the entire epigastrium.

On Nov. 20, 1944, operation was performed (Nygaard). Careful intra-abdominal exploration revealed no demonstrable pathologic changes except those referable to the stomach. High on the lesser curvature an induration could be palpated. This was adherent to the underlying peripancreatic capsule. Along the major curvature, opposite the incisura, a well limited single tumor of elastic hard consistency, about half the size of a walnut, could be

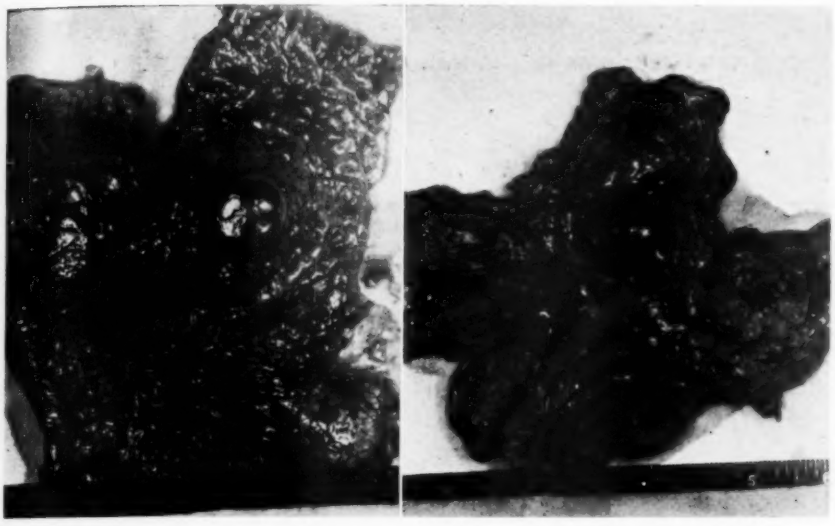

Fig. 4. The appearance of the resected specimen with the tumor, from the mucosal and serosal surface.

palpated. No nodes were noted along the lesser or major curvature. A subtotal gastric resection with a posterior Polya anastomosis was performed.

The proximally located induration proved to be a benign gastric ulcer of the perforating type. The single tumor along the major curvature was found to be entirely intramural, stretching the serosa and normally preserved mucosa over its slightly bulging anterior and posterior aspects. Because of this bulging, the mucosa appeared stretched out over the tumor, thereby losing its rugae. The microscopic examination proved the tumor to be a fibroma with a few strands here and there of myomatous tissue.

The patient underwent an uneventful recovery and was dismissed from the hospital Dec. 11, 1944.

SUMMARY

The roentgen findings in a case of fibromyoma of the greater curvature of the stomach are presented. The patient's symptoms, on clinical examination, were due to a shallow ulceration on the lesser curvature of the stomach. This was associated with absence of free hydrochloric acid in the fasting specimen.

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A Simple Polygraph[1]

MAJ. E. WAYNE EGBERT, M.C., A.U.S., and ALFRED G. FULLER[2]

WHEN CONSERVATION of x-ray film is a consideration, both industrially and medically, a method, which for lack of a better name we have called a simple polygraph, may be useful, reducing by approximately 50 per cent the amount of film ordinarily used in certain examinations. We have employed the simple polygraph for more than a year and have found it of distinct advantage in the conservation not only of film but also of developing chemicals, film hangers, cassettes, intensifying screens, and time required for producing a certain amount of work. The method has been used in examination of the wrist, mastoids, paranasal sinuses, temporomandibular joints, and the elbow.

The procedure requires only a 10 × 12-inch sheet of lead, 1/32 of an inch in thickness, applied with Casco glue to a masonite backing of the same size in order to make it stable. From one corner a 5 × 6-inch cutout is made (Fig. 1). The device is utilized in non-screen or screen examinations by uniformly rotating it over the film with each additional exposure and position.

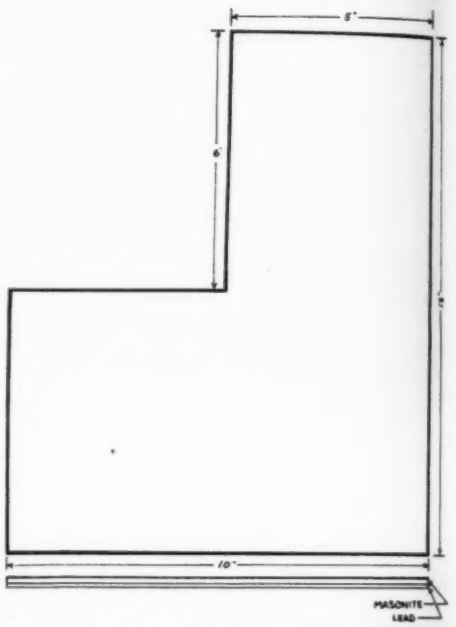

Fig. 1. Diagram of lead sheet used for making simple polygraphs.

In examination of the wrist we have found it essential to obtain routinely more than the usual anteroposterior and lateral views. Therefore, we supplement these with both oblique views (Fig. 2). This practice has proved extremely valuable in cases of carpal injury. Fractures of the carpal navicular are many times more common in the Army than the usual Colles' fracture of civilian life, and the four-view technic is an essential for their diagnosis.

Anteroposterior, lateral, and flexion examinations of the elbow joint are well accommodated by this method (Fig. 3).

Open- and closed-mouth views of the temporomandibular joint are easy to compare on the viewing box, when all are combined on the one 10 × 12-inch film (Fig. 6). Mastoid examinations are likewise facilitated with the two views of each mastoid side by side on the same film (Fig. 4).

We feel that four views are usually adequate to demonstrate disease in any or all of the paranasal sinuses. With the simple polygraph method, views in the Caldwell, Waters, and exaggerated Waters positions (the last for visualization of the sphenoid sinuses) and lateral views are no more difficult to obtain than on individual 8 × 10-inch films. The saving of film in this case is obvious, and the ease of examination when multiple views of a single part are combined on a single film (Fig. 5) will be readily appreciated by the busy roentgenologist.

The technical factors involved in obtain-

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[2] Civilian technician.

Fig. 2. Simple polygraph of wrist, showing postero-anterior, lateral, and two oblique views.

Fig. 3. Simple polygraph of elbow: anteroposterior view and lateral and postero-anterior views in flexion.

Fig. 4. Simple polygraph of mastoids, showing two views of each on a single film.

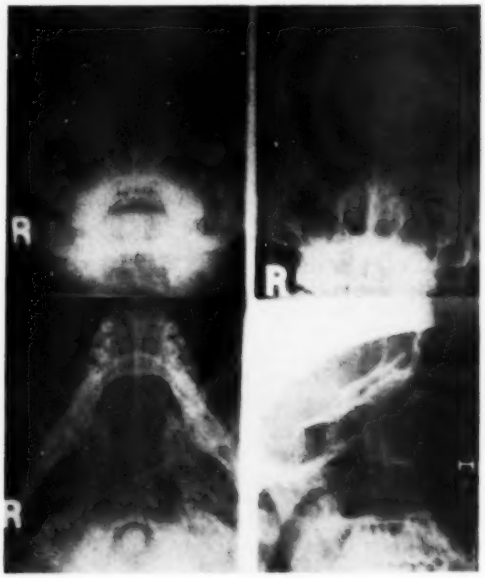

Fig. 5. Simple polygraph of paranasal sinuses, showing four views on a single film.

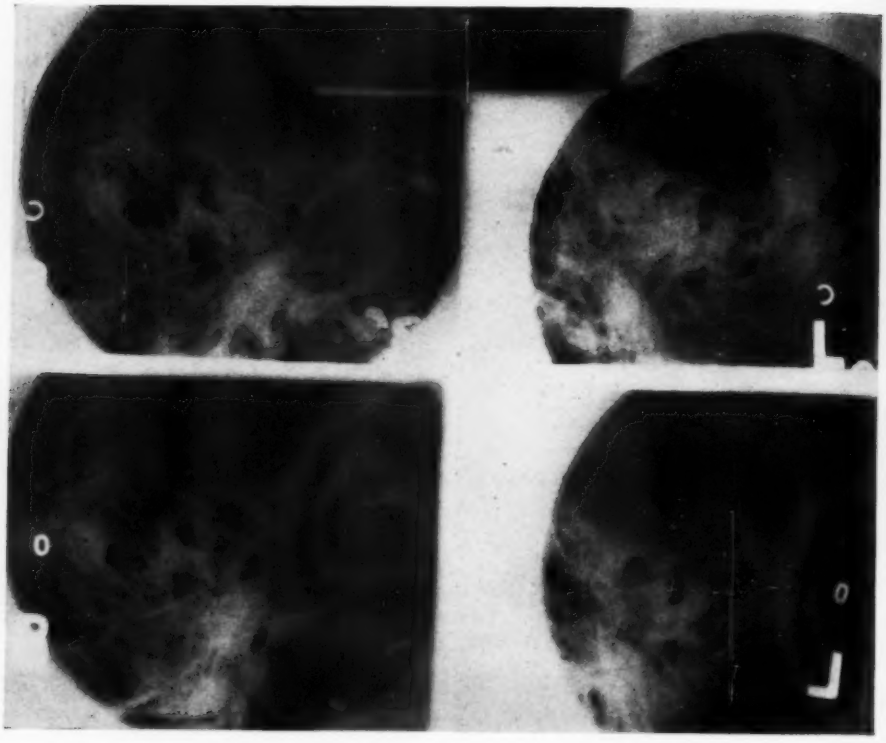

Fig. 6. Simple polygraph of temporomandibular joint.

ing the views reproduced here were as follows:

Wrist (Fig. 2)
36-inch distance
4-inch cylinder cone
Non-screen cardboard holder
1.0 mm. Al

Postero-anterior	50 kv.p.	75 ma. sec.
Lateral	60 kv.p.	75 ma. sec.
Postero-anterior and anteroposterior oblique	55 kv.p.	75 ma. sec.

Elbow (Fig. 3)
36-inch distance
4-inch cylinder cone
Non-screen cardboard holder
1.0 mm. Al

Anteroposterior	65 kv.p.	75 ma. sec.
Lateral, 90° flexion	65 kv.p.	75 ma. sec.
Postero-anterior, acute flexion	75 kv.p.	75 ma. sec.

Mastoids and temporomandibular joints (Figs. 4 and 6)
30-inch distance
4-inch cylinder cone
Parspeed screens
1.0 mm. Al

Lateral	55 kv.p.	75 ma. sec.
Stenvers position	48 kv.p.	75 ma. sec.

Paranasal sinuses (Fig. 5)
30-inch distance
4-inch cylinder cone
Parspeed screens
1.0 mm. Al

Caldwell position	66 kv.p.	45 ma. sec.
Waters position	70 kv.p.	45 ma. sec.
Vertico-submental	74 kv.p.	45 ma. sec.
Lateral	55 kv.p.	30 ma. sec.

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Primary Ewing's Sarcoma of the Spine[1]

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PRIMARY EWING'S sarcoma of the spine is sufficiently rare to justify the reporting of an additional case. The roentgenographic changes in that location obviously are not those typical of similar involvement of the long bones. A survey of the pertinent literature reveals 10 cases of primary Ewing's sarcoma of the spine.

In a review of the material in the Bone Sarcoma Registry (1927) and a comprehensive discussion of sarcoma of the bone, Kolodny (1) states that Ewing's sarcoma constitutes 7.5 per cent of bone sarcomas. In his opinion, a Ewing's sarcoma usually affects more than one vertebra, but he believes that this represents multiple primary involvement and not metastatic growth. He reports a series of 650 cases of bone tumor with 40 instances of Ewing's sarcoma and 10 others of more or less doubtful nature. The spine is mentioned as being a favorite site of the tumor, but the incidence of such involvement is not given.

Rix and Geschickter (2) report a series of 291 tumors of the spine, of which 21 were primary malignant neoplasms. They report no cases of Ewing's sarcoma but list 12 cases of sympathicoblastoma and discuss the possibility of it being confused with a Ewing's sarcoma.

Geschickter and Copeland (3) report a series of 125 cases of Ewing's sarcoma and list one instance of primary involvement of the vertebra.

Geschickter and Maseritz (4) discuss the clinical and microscopic similarity of neuroblastoma and Ewing's sarcoma and report a series of 135 cases of the latter tumor. No mention of primary involvement of the spine is made.

Stewart Harrison (5) reports 8 cases of Ewing's bone sarcoma, none of which was primary in the spine.

Lattman (6) published a review on Ewing's sarcoma but did not mention primary occurrence in the spine. He states that primary malignant disease of the bone is rare (1.5 to 2.0 per cent of all malignant neoplasms), with Ewing's sarcoma accounting for approximately 10 per cent of the bone sarcomas.

Brav and Rechtman (7) reported a single case of a Ewing's sarcoma primary in the sacrum, with autopsy findings.

Neely and Rogers (8) report two cases of primary bone neoplasm of the spine with a histopathological picture consistent with Ewing's sarcoma. These two cases showed no cell type compatible with a diagnosis of sympathicoblastoma.

In a more recent study, Morton (9) reports 6 cases of Ewing's sarcoma of the spine as listed in the Bone Sarcoma Registry (covering the period up to the fall of 1936). A total of 184 cases of Ewing's sarcoma of bone were listed in the Registry for the same period.

CASE REPORT

Clinical History: A white male, aged 21 years, was admitted to the Letterman General Hospital, March 21, 1944, for deep x-ray therapy to the 12th dorsal vertebra and the right 12th rib. The family history was irrelevant and the developmental history was normal.

The patient had been well until September 1943, when he experienced a sudden sharp pain in his right hip. From November 1943 until January 1944, he was hospitalized on several occasions and treated for a subgluteal bursitis. Following his discharge from the hospital on Jan. 9, 1944, he was well until Jan. 15. On the latter date, he was lifting a plank and "felt something snap in the middle of the back." Moderately severe pain developed and persisted, and sometime between Jan. 15 and Jan. 27 a mass appeared at the right costovertebral angle. The patient complained of pain radiating down the anterior aspect of each thigh, and upon further questioning, it was learned that he had noticed some tremors of the lower extremities since October 1943.

The patient was admitted to a station hospital on Jan. 27, 1944, and at that time was also complaining

[1] Accepted for publication in May 1945.

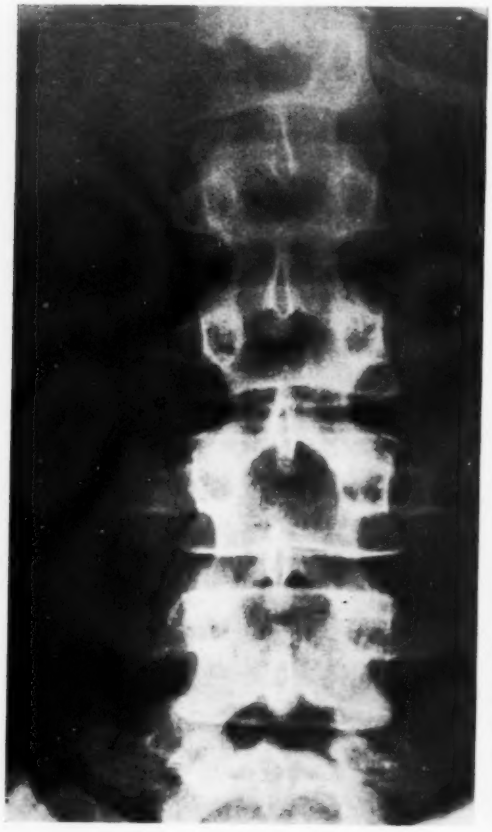

Fig. 1. Original film made Feb. 2, 1944, showing an osteolytic process involving the right half of the 12th thoracic vertebra.

Fig. 2. Rapid increase in the destructive process, as shown by roentgenogram of March 27, 1944. Diagnosis of Ewing's sarcoma established by biopsy.

of urinary frequency and nocturia. X-ray examination of the spine showed an osteolytic process involving the 12th thoracic vertebra and the right 12th rib. He was transferred to a general hospital on Feb. 14, 1944, and tissue removed for microscopic diagnosis disclosed the presence of a Ewing's sarcoma. Before the patient could be transferred for deep x-ray therapy, an upper respiratory infection occurred. A paraplegia rapidly developed and by Feb. 20 was complete. A right hemilaminectomy of the 10th, 11th, and 12th dorsal vertebrae was done Feb. 28, with removal of a large amount of tumor. The patient was transferred to Letterman General Hospital on March 21, 1944.

On admission to Letterman General Hospital, the patient was pale and emaciated, with a complete paralysis of both lower extremities, rectal and bladder incontinence, and loss of all reflexes of both lower extremities. He complained of considerable pain in the region of the 12th thoracic vertebra.

Pathological Report: The small bits of tissue removed for diagnosis were all similar in histologic structure, showing different sized nests of large neoplastic cells, separated by strands of fibrous tissue. There were a few small areas of hemorrhage and at the periphery of the pieces of tissue were occasional bone spicules, some of which were bordered by large osteoclasts. The tumor cells grew in large, solid sheets, without any particular structure. The cytoplasm was clear and the nuclei large and vesicular, with an occasional prominent nucleolus. Frequent bizarre mitotic figures were seen. There were a few blood vessels in the tumor within bands of fibrous tissue. The nuclei of the endothelium of the vessels were swollen and bore a close resemblance to those of the tumor in some instances. *Diagnosis:* Endothelial sarcoma of bone (Ewing's sarcoma).

Operative Findings: The right lamina of the 12th thoracic vertebra was soft and mushy, and the particles of bone were easily removed. The tumor extended laterally to the right and a moderate amount was excised. The right lamina of the 11th

thoracic vertebra was also softened and easily removed. The right lamina of the 10th thoracic vertebra was more normal in consistency and, upon its removal, a thin sheet of tumor was found along the exposed dura.

Irradiation Therapy: The irradiation factors were: 200 kv.; added filtration 0.5 mm. Cu and 1.0 mm. Al; 18 ma.; output 28.5 r/min. measured in air; 50 cm. S.T.D.; h.v.l. 0.9 mm. Cu; area 400 sq. cm. divided into four 10 × 10 cm. ports. The patient was treated daily with 200 r (in air) to each of two ports for a total of 1,400 r (in air) to each of the four ports. A second series of treatments (same factors and same areas) was begun on May 18 and completed May 26, 1944, with a total of 800 r (in air) to each of the four ports. The total tumor dose is estimated as being 1,800 r.

X-Ray Findings: Films made Feb. 2, 1944 (Fig. 1) show an osteolytic process involving the right half of the 12th thoracic vertebra, with almost complete destruction of the cortex and body of that portion of the vertebra. The right transverse process is absent, probably destroyed. The right 12th rib is partially destroyed and is displaced superiorly. The right pedicle and lamina of the 12th thoracic vertebra are largely destroyed. There is no evidence to suggest new bone formation. No unusual soft-tissue shadows were noted. A complete skeletal survey disclosed no other bone lesions. The lung fields were entirely clear.

Admission films, taken March 27, 1944, at Letterman General Hospital (Fig. 2), show a complete destruction of the entire right half of the 12th thoracic vertebra with the exception of a thin cortical plate on the intervertebral margins. The cortex of the lateral half of the body is completely destroyed. There is no apparent compression of the body of this vertebra nor any apparent narrowing of the interspaces. The right 12th rib is completely destroyed, with the exception of a very small portion of its tip. The residual portion of the tip of this rib is displaced outward and downward from its original position. There is a large soft-tissue tumor occupying this entire area, measuring 10 × 15 cm. Irregular areas of increased density are scattered throughout the center of the mass and probably represent incompletely destroyed fragments of the 12th rib and 12th thoracic vertebra.

Roentgenograms made April 15, 1944, five and a half weeks after completion of the first course of deep x-ray therapy (Fig. 3), show a marked reduction in the size of the tumor, with dense recalcification of the destroyed portion of the vertebra and the residual mass at the location of the 12th rib. The stature of the body of the 12th thoracic vertebra has been maintained. Repeated chest films continued to show no evidence of metastases.

Clinical Progress: On the third day of x-ray therapy the patient voluntarily stated that he had experienced considerable relief of pain. Pain relief was complete by the fifth day. The tumefaction at the right costovertebral margin rapidly decreased in size. Within one week the patient was able to distinguish gross differences in temperature over both lower extremities, more marked on the left. There was an associated minimal return of muscular movements, particularly in the gluteal muscles. The next six weeks showed an increase in sensory acuity but only a very slight increase in the muscle movements. Rectal and bladder incontinence persisted.

Fig. 3. Dense recalcification five and a half weeks after first course of deep x-ray therapy.

SUMMARY

A single case of primary Ewing's sarcoma of the spine is described. The initial involvement was in the right half of the 12th thoracic vertebra, with no evidence of spread to the lungs or other bones. The response to irradiation therapy was typical of a Ewing's bone sarcoma. It is not anticipated that this patient will obtain

any more than temporary palliation. Only ten cases of similar involvement of the spine have been reported.

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Enlarged Parietal Foramina and Similar Shadows Seen in Osteoporosis Circumscripta: Two Cases[1]

CHARLES H. KELLEY, M.D.
Washington, D. C.

THE ROENTGENOLOGIC recognition of enlarged parietal foramina is not difficult. While these are not a common finding, radiologists generally are familiar with the appearance of such defects in the upper posterior angle of the parietal bones. A similar picture may, however, be obtained in other diseases of bone, one of which is osteoporosis circumscripta. Of the two cases recorded below, one showed enlarged parietal foramina, with a history suggestive of an inherited character; the other is a case of osteoporosis circumscripta producing defects simulating enlarged parietal foramina.

The typical x-ray findings in the two conditions, with adequate reviews of the literature, are fully covered in articles by Kasabach and Gutman (1) on osteoporosis circumscripta, and by Pepper and Pendergrass (2) on enlarged parietal foramina. The reader is referred to these comprehensive treatises for such additional information as he may desire.

CASE REPORTS

CASE I: S. G. is an American Negro female, 33 years old, married and the mother of a daughter 18 years old. The patient was first seen in the Medical Clinic of Freedmen's Hospital in February 1944 with a multinodular fibroid tumor of the uterus, which was successfully removed. In her case history she called attention to "soft spots" in her skull, present since birth. Other members of her family were said to have similar defects regarded by them as a family secret. Indeed, the patient was admonished by some of her relatives for betraying their secret and submitting to an x-ray examination of the skull. Large parietal foramina were well seen on the films (Fig. 1).

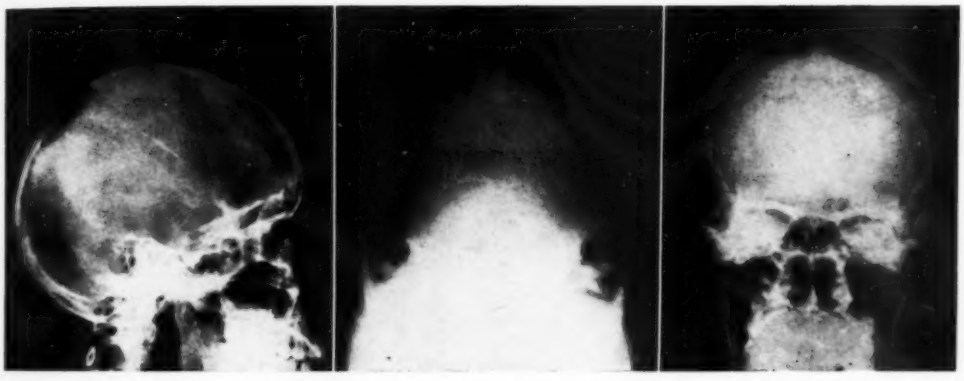

Fig. 1. Case I: Three views of the skull showing enlarged parietal foramina.

According to the history similar defects of the skull occurred in the patient's maternal grandmother, a male cousin on the mother's side, and in two sisters, aged 24 and 32 years. A brother, 20 years old, did not have these defects. The patient's daughter had a normal skull. Since most of the members of her family did not live in the District of Columbia, they could not be seen for questioning.

CASE II: O. B., an American Negro female, age 45, unmarried, came to the Surgical Clinic of Freedmen's Hospital in November 1941, complaining of pain along the margins of her upper gums,

[1] From the X-ray Department of Freedmen's Hospital and Howard University College of Medicine, Washington, D. C. Accepted for publication in July 1945.

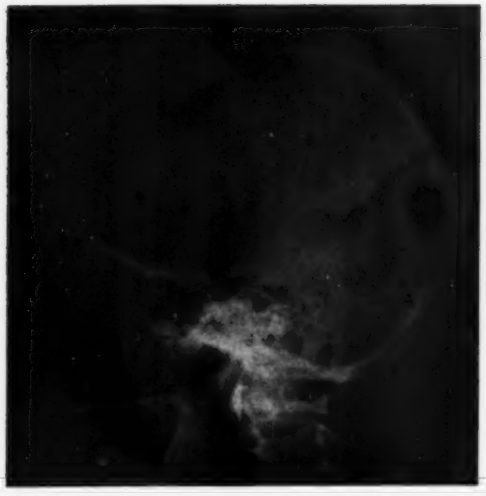

Fig. 2. Case II: Shadows resembling enlarged parietal foramina in a patient with osteoporosis circumscripta.

radiating backward and of approximately a year's duration. She had been advised to have her upper teeth removed, and this was done six months prior to her visit to our clinic, without relief of pain. The patient was then referred to the x-ray department with the clinical impression of a calculus in a salivary duct, but none was found on roentgen examination.

Routine films of the skull disclosed osteoporosis circumscripta. An unusual finding was rounded symmetrical shadows located at the upper angle of the parietal bone on either side of the cranium. These shadows were sharply defined and resembled enlarged parietal foramina (Figs. 2 and 3). The skull defects were three in number, against two usually seen in enlarged parietal foramina. The location and shape of the shadows, however, fitted the description of enlarged parietal foramina.

Three years later the patient was again examined. Decalcification of the skull had increased, and the rounded shadows originally seen in the region of the parietal foramina were no longer present (Fig. 4.). This is strong evidence against a diagnosis of enlarged parietal foramina. The patient had no knowledge of defects in her skull or of the occurrence of such defects in any members of her family. Her only living relative was a brother, films of whose skull were normal.

Fig. 3. Case II: Other views of the skull showing shadows similar to those produced by enlarged parietal foramina.

CONCLUSION

Two cases showing bilateral rounded defects at the upper angles of the parietal bones are presented. In one of these cases the findings are typical of enlarged parietal foramina. In the other case, the defects seem to be a part of changes occurring in osteoporosis circumscripta, since they were

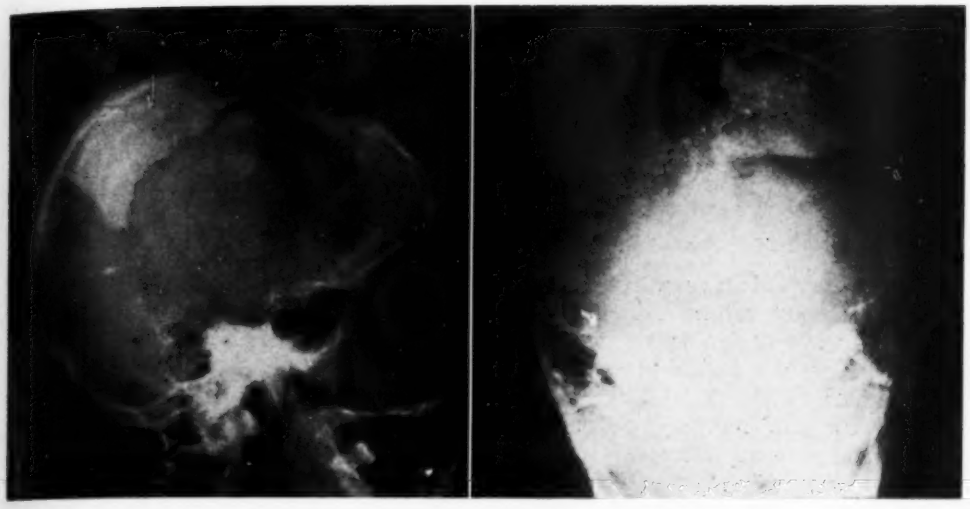

Fig. 4. Case II: Roentgenograms made three years after those reproduced in Figs. 2 and 3, showing increased decalcification of the skull. The rounded shadows in the region of the parietal foramina are no longer demonstrable.

not present in films taken three years after they were first discovered.

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EDITORIAL

Skeletal Lesions Associated with Neurofibromatosis

The discovery of an association between lesions involving various systems of the body is always a significant step in the understanding of a disease process. Thus, observations on the skeletal defects associated with the multiple pedunculated tumors and café au lait spots characteristic of von Recklinghausen's neurofibromatosis have gone far toward clarifying the etiology of that condition. That a relationship exists between the superficial tumors and the pathologic process in the bones has become increasingly apparent.

Adrian (1), as early as 1901, called attention to the frequent occurrence of bone lesions in neurofibromatosis, but Stahnke (9) was the first to regard these lesions as part of a systemic involvement. Brooks and Lehman (3) studied the bone changes in the disease and their report, published in 1924, is among the first in the American literature to recognize the osseous lesions as a characteristic manifestation of neurofibromatosis and one which may be of diagnostic significance, more especially in cases in which the so-called "classical" features are not fully developed. They reported seven cases, to which Lehman (6) subsequently added two more. Three types of bony change occurred: scoliosis, abnormalities of bone growth, and "irregularities of outline of the shafts of the long bones, including changes which in the x-ray film appear as subperiosteal cysts."

Though scoliosis was observed in all the cases recorded by Brooks and Lehman, and appears to be almost universally present, they do not consider it characteristic of the disease. In some instances, they believe, it may be due to primary changes in the spine, possibly developmental and possibly related to the changes in the long bones, while in other cases it may be compensatory for unequal length of the lower extremities. This latter feature was present in three of their patients, being due to excessive growth in two cases, involving the tibia and femur, respectively, and to a shortening of the femur in a third, presumably the result of cystic changes. Spontaneous overgrowth in length of a single long bone these authors believe is to be found in no other condition than von Recklinghausen's disease. It is their opinion that it is usually associated with a congenital elephantiasis. Nørgaard (8) in a more recent paper attributed it to an embryogenic defect.

Localized bone hypertrophy in association with neurofibromatosis was also observed by Moore (7), who reported four cases. The fact that a definite segmental relationship was found to exist between the affected nerve and the overgrowth seemed to him to be the strongest evidence that the neurofibromatosis is responsible for the hypertrophy. The facts as he sees them are as follows: "(1) Localized hypertrophy is often enough associated with neurofibromatosis in a segmental relationship to warrant a belief that there is a causal relationship of the nerve lesion to the hypertrophy. (2) The hypertrophy is not pure overgrowth, but is mixed over- and underdevelopment, and we believe represents uncontrolled growth rather than stimulation of growth. (3) The findings of definite evidence of endarteritis in two of these cases, and hints of it in the other two, may, we believe, have a bearing on the question of the control of normal bone growth."

The third type of bone change noted by Brooks and Lehman varied from slight periosteal and cortical changes to large tumors having the roentgen appearance of bone cysts. These tumors are said to be composed of tissue similar to that found in the skin tumors in association with new formed trabeculae. Their observations, the authors believe, emphasize the fact that neurofibromatosis is a condition affecting osseous structures as well as skin and nerves.

Pseudarthrosis and bowing of the lower leg as a concomitant of neurofibromatosis were reported by Ducroquet (4) in France in 1937, but seem to have escaped notice in the British and American literature until 1939, when Barber (2) recorded five cases of his own and presented in summary the ten cases of his French contemporary. In both series of cases there was definite evidence of a familial tendency. In four of Barber's cases bowing of the leg had been present since birth. Pseudarthrosis followed osteoclasis or osteotomy for correction of the deformity in two cases and fractures in two others. Moore's report, cited above, also included a discussion of pseudarthrosis. Three cases selected from a series of eight were presented. In one case there was histologic proof of neurofibromatosis and in the others the clinical features were unmistakable. In discussing these cases, Moore states that, "since pathological nerves are found in relation to the pathological bone, it seems fair to assume that the two are related." He believes that the tumor of the nerve and the pseudarthrosis stand in the relation of cause and effect, though the mechanism of the production is not entirely clear.

A recent report of a typical case of pseudarthrosis by Green and Rudo (5) adds further proof of the association of neurofibromatosis and pseudarthrosis. In their patient bone defects were observed previous to fracture. The fracture followed slight trauma and failed to unite until after excision of neurofibromatous tissue at the fracture site. A second fracture went through a similar cycle. The excised material was identical microscopically with the usual picture of neurofibroma. In this case it appeared that the intraosseous neurofibromas developed from nerves within the bone rather than those of the periosteum.

The reports cited above and others furnish cumulative evidence of the existence of bone involvement as well as skin and nerve lesions in neurofibromatosis. Particularly convincing is the evidence that neurofibromatosis is the exciting cause of congenital bowleg and pseudarthrosis. In such cases a careful search should be made for other evidence of the disease, including café au lait spots and tumors of the peripheral nerves and skeletal system.

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AMERICAN RADIUM SOCIETY

The American Radium Society will hold its next annual meeting in the Assembly Hall of the Health Center, in San Francisco, June 28–29. An unusually fine program has been arranged, including papers on the treatment of cancer of the eyelid, tongue, anal canal, breast, larynx, and vagina. An elaborate symposium on cancer of the cervix will be presented by a group of distinguished radiologists and surgeons, and new developments in the use of radioactive substances will be discussed by six authorities on this subject. Dr. Frederick O'Brien, of Boston, will give the Janeway Lecture, and the annual dinner will be held on Friday night, June 28.

THE NEW ENGLAND ROENTGEN RAY SOCIETY

The Annual Meeting of the New England Roentgen Ray Society was held at the Harvard Club, Boston, on Friday, May 17, 1946. Dr. Arthur C. Christie gave the George W. Holmes Annual Lecture, his subject being "The First Fifty Years of Radiology. The Elements Which Have Contributed to Its Growth as a Great Medical Specialty." Dr. Holmes and Dr. Christie were each presented with the Society's silver colonial pitcher, which is emblematic of the occasion.

The newly elected officers of the Society are Samuel A. Robins, M.D., President, Stanley A. Wilson, M.D., Vice-President, and George Levene, M.D., Secretary.

TENNESSEE RADIOLOGICAL SOCIETY

At a recent meeting of the Tennessee Radiological Society, held in Knoxville, the following officers were elected: Dr. Leon M. Lanier, President; Dr. J. Cash King, Vice-President; Dr. J. Marsh Frère, Secretary-Treasurer. Dr. Robert A. Arens of Chicago was the guest speaker, choosing for his subject "Pneumoperitoneum".

The State Medical Association, meeting at the same time, elected radiologists to fill its highest offices, Dr. C. M. Hamilton of Nashville and Dr. Franklin D. Bogart of Chattanooga being chosen President and President-Elect, respectively. Both Dr. Hamilton and Dr. Bogart are members of the Tennessee Radiological Society and of the Radiological Society of North America.

DR. WENDELL G. SCOTT APPOINTED TO BOARD OF RESERVE CONSULTANTS, U.S.N.

Word has recently been received of the appointment of Dr. Wendell G. Scott to the Board of Reserve Consultants to the Surgeon General of the U. S. Navy. This appointment is not only a recognition of Dr. Scott's services during the war but is also an honor to the specialty of radiology, which has not previously been represented on the Surgeon General's Board of Consultants for the Navy.

The main function of this Board is to advise in matters pertaining to the Graduate Training Program of the Navy Medical Corps, to assist in the choice of reserve consultants to the staff of Navy hospitals and to visit and survey Navy hospitals according to the necessity of the teaching program.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

THE TRAUMATIC DEFORMITIES AND DISABILITIES OF THE UPPER EXTREMITY. By ARTHUR STEINDLER, M.D., F.A.C.S., Professor and Head of the Department of Orthopedic Surgery, The State University of Iowa, in collaboration with JOHN LOUIS MARXER, M.D., Associate, Orthopedic Department, The State University of Iowa. A volume of 515 pages with 1048 illustrations. Published by Charles C Thomas, Springfield, Ill., 1946. Price $10.00.

EL TORAX RADIOLOGICO DEL NIÑO EN LAS ENFERMEDADES INFECTO-CONTAGIOSAS. By RODOLFO E. TISCORNIA, Radiologo del Hospital Pedro Visca de Montevideo. A volume of 138 pages, with 37 illustrations. Published by Espasa-Calpe, Argentina, S. A., 1945.

Book Reviews

STUDIES ON PROTEIN METABOLISM IN THE CELLS OF EPITHELIAL TUMOURS. By TORBJÖRN CASPERSSON AND LARS SANTESSON. Supplementum LXVI to Acta Radiologica. A volume of 105 pages, with 87 photomicrographs. Published by P. A. Norstedt & Söner, Stockholm, 1943.

This monograph comes from the Chemical and Radio-Pathological Institutions of the Caroline Institute. The basis of the studies recorded was an attempt to discover how the cellular protein-forming system, the basic mechanism in all cellular growth and multiplication, functions in malignantly growing cells. Epithelial tumors, the cells of which are generally richer in cytoplasm than those of other tumors, were chosen for investigation. Special

methods of cytochemical analysis developed by the authors have facilitated the quantitative determination of proteins and nucleic acids in individual cell structures.

Analysis of the material shows that the system of protein formation in all the cells in a tumor is markedly stimulated. According to the functional state of the tumor cells, they may be divided into two main groups, here called A-type and B-type, with all intermediary transitions.

The A-type cells are those engaged in extremely intense growth and division. They are not seen in the normal adult organism but only in early embryonic stages, during periods of particularly active growth. The A cells always predominate in those tumor areas which can be assumed to have the best nutrition. In areas where distance to the surface and to blood vessels is relatively great, cells of extreme B-type are found. It seems that when, during the growth of the tumor, the nutritive conditions for a particular cell group become impaired, there takes place a gradual development toward the B-type of cell and finally from it to necrosis.

A somewhat detailed discussion of the protein-forming system and its intracellular components, both structural and chemical, in the several types of cells, is presented. The authors state that by their studies the degree of growth and the type of growth in individual cells can be determined.

No wholly characteristic cytologic or chemical features of the malignant tumor cell have been discovered, but a number of findings seem to have rather widespread application. The heterochromatic sections (a specific portion of the nuclear chromatin) of the nucleus play a very special role not only in growth of the cancer but also in carcinogenesis. An intensive hyperfunction of the heterochromatin was characteristic of all cells examined. Presumptive application of this finding is made to all malignant tumors.

CANCER OF THE LIP. A CLINICAL STUDY OF 778 CASES WITH PARTICULAR REGARD TO PREDISPOSING FACTORS AND RADIUM THERAPY. BERTIL EBENIUS. Supplementum XLVIII to Acta Radiologica. A volume of 232 pages, with 26 illustrations and 37 tables. Published by P. A. Norstedt & Söner, Stockholm, 1943.

This report from the Radiumhemmet, Stockholm, based on a clinical study of 778 cases of cancer of the lip, covers the subject in great detail. Predisposing factors receive much consideration, and the author arrives at some conclusions in this field which are specific and seem well grounded. Many related questions are considered and the solutions reached seem well substantiated.

Radium treatment is discussed at length. The long period of observation and the detailed information recorded on each patient give the impression that the wealth of statistical information contained in the article is well authenticated, which accords with the reputation of the Radiumhemmet for careful follow-up studies, accurately reported. The treatment of the subject is comprehensive and unprejudiced.

RADIOLOGICAL SOCIETIES OF NORTH AMERICA

Editor's Note.—Will secretaries of societies please cooperate by sending information to Howard P. Doub, M.D., Editor, Henry Ford Hospital, Detroit 2, Mich.

UNITED STATES

Radiological Society of North America.—Secretary, D. S. Childs, M.D., 607 Medical Arts Bldg., Syracuse 2, N.Y.

American Roentgen Ray Society.—Secretary, Harold Dabney Kerr, M.D., Iowa City, Iowa.

American College of Radiology.—Secretary, Mac F. Cahal, 20 N. Wacker Dr., Chicago 6, Ill.

Section on Radiology, American Medical Association.—Secretary, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

ARKANSAS

Arkansas Radiological Society.—Secretary, Fred Hames, M.D., Pine Bluff. Meets every three months and annually at meeting of State Medical Society.

CALIFORNIA

California Medical Association, Section on Radiology.—Secretary, Gordon King, M.D., Children's Hospital, San Francisco.

Los Angeles County Medical Association, Radiological Section.—Secretary, Roy W. Johnson, M.D., 1407 South Hope St., Los Angeles. Meets second Wednesday of each month at County Society Building.

Pacific Roentgen Society.—Secretary, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with California Medical Association.

San Diego Roentgen Society.—Secretary, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego, Calif. Meets first Wednesday of each month.

San Francisco Radiological Society.—Secretary, Joseph Levitin, M.D., 516 Sutter St., San Francisco 2. Meets monthly on the third Thursday at 7:45 P.M., first six months of the year in Lane Hall, Stanford University Hospital, and second six months in Toland Hall, University of California Hospital.

COLORADO

Denver Radiological Club.—Secretary, A. Page Jackson, Jr., M.D., 304 Republic Bldg., Denver 2. Meetings third Friday of each month, Denver Athletic Club.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Secretary, Max Climan, M.D., 242 Trumbull St., Hartford 3. Meetings bimonthly, second Thursday.

FLORIDA

Florida Radiological Society.—Secretary-Treasurer, J. F. Pitman, M.D. Blanche Hotel Annex, Lake City.

GEORGIA

Georgia Radiological Society.—Secretary-Treasurer, James J. Clark, M.D., 478 Peachtree St., N. E., Atlanta 3. Meets in November and at the annual meeting of State Medical Association.

ILLINOIS

Chicago Roentgen Society.—Secretary, Fay H. Squire, M.D., 1753 W. Congress St., Chicago 12. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April.

Illinois Radiological Society.—Secretary-Treasurer, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—Secretary, Frank S. Hussey, M.D., 250 East Superior St., Chicago 11.

INDIANA

The Indiana Roentgen Society.—Secretary-Treasurer, Harold C. Ochsner, M.D., Methodist Hospital, Indianapolis 7. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Secretary, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of Iowa State Medical Society.

KENTUCKY

Kentucky Radiological Society.—Secretary-Treasurer, Sydney E. Johnson, M.D., 101 W. Chestnut St., Louisville.

LOUISIANA

Louisiana Radiological Society.—Secretary-Treasurer, Johnson R. Anderson, M.D., North Louisiana Sanitarium, Shreveport. Meets annually at same time as State Medical Society.

Orleans Parish Radiological Society.—Secretary, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

Shreveport Radiological Club.—Secretary, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday, 7:30 P.M.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Secretary, Charles N. Davidson, M.D., 101 West Read St., Baltimore 1.

MICHIGAN

Detroit X-ray and Radium Society.—Secretary-Treasurer, E. R. Witwer, M.D., Harper Hospital, Detroit 1. Meetings first Thursday of each month from October to May, at Wayne County Medical Society club rooms.

MINNESOTA

Minnesota Radiological Society.—Secretary, A. T. Stenstrom, M.D., Minneapolis General Hospital, Minneapolis 26. Meetings quarterly.

MISSOURI

Radiological Society of Greater Kansas City.—Secretary, John W. Walker, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Friday of each month.

St. Louis Society of Radiologists.—Secretary, Edwin C. Ernst, M.D., 100 Beaumont Medical Bldg. Meets on fourth Wednesday of each month, October to May.

NEBRASKA

Nebraska Radiological Society.—Secretary-Treasurer, Donald H. Breit, M.D., University of Nebraska Hospital, Omaha 5. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

NEW ENGLAND

New England Roentgen Ray Society.—Secretary-Treasurer, George Levene, M.D., Massachusetts Memorial

Hospitals, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

NEW HAMPSHIRE

New Hampshire Roentgen Society.—Secretary-Treasurer, Richard C. Batt, M.D., St. Louis Hospital, Berlin.

NEW JERSEY

Radiological Society of New Jersey.—Secretary, H. R. Brindle, M.D., 501 Grand Ave., Asbury Park. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called.

NEW YORK

Associated Radiologists of New York, Inc.—Secretary, William J. Francis, M.D., East Rockaway, L. I.

Brooklyn Roentgen Ray Society.—Secretary-Treasurer, Abraham H. Levy, M.D., 1354 Carroll St., Bklyn. 13. Meets fourth Tuesday of every month, October to April.

Buffalo Radiological Society.—Secretary-Treasurer, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen Society.—Secretary-Treasurer, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse 10. Meetings in January, May, and October.

Long Island Radiological Society.—Secretary, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—Secretary, Wm. Snow, M.D., 941 Park Ave., New York 28.

Rochester Roentgen-Ray Society.—Secretary, Murray P. George, M.D., 260 Crittenden Blvd., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

NORTH CAROLINA

Radiological Society of North Carolina.—Secretary-Treasurer, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meets in May and October.

NORTH DAKOTA

North Dakota Radiological Society.—Secretary, Charles Heilman, M.D., 1338 Second St., N., Fargo.

OHIO

Ohio Radiological Society.—Secretary, Henry Snow, M.D., 1061 Reibold Bldg., Dayton 2. Next meeting at annual meeting of the Ohio State Medical Association.

Cleveland Radiological Society.—Secretary-Treasurer, Carroll C. Dundon, M.D., 11311 Shaker Blvd., Cleveland 4. Meetings at 6:30 P.M. on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*Secretary-Treasurer,* Samuel Brown, M.D., 707 Race St., Cincinnati 2. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—Secretary-Treasurer, L. E. Wurster, M.D., 416 Pine St., Williamsport 8. The Society meets annually.

Philadelphia Roentgen Ray Society.—Secretary, Calvin L. Stewart, M.D., Jefferson Hospital, Philadelphia 7. Meets first Thursday of each month at 8:00 P.M., from October to May in Thomson Hall, College of Physicians, 21 S. 22d St.

Pittsburgh Roentgen Society.—Secretary-Treasurer, Lester M. J. Freedman, M.D., 4800 Friendship Ave., Pittsburgh 24. Meets second Wednesday of each month at 6:30 P.M., October to May, inclusive, at The Ruskin, 120 Ruskin Ave.

ROCKY MOUNTAIN STATES

Rocky Mountain Radiological Society (North Dakota, South Dakota, Nebraska, Kansas, Texas, Wyoming, Montana, Colorado, Idaho, Utah, New Mexico).—*Secretary,* A. M. Popma, M.D., 220 North First St., Boise, Idaho.

SOUTH CAROLINA

South Carolina X-ray Society.—Secretary-Treasurer, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee Radiological Society.—Secretary-Treasurer, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

TEXAS

Dallas-Fort Worth Roentgen Study Club.—Secretary, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meetings on third Monday of each month, in Dallas in the odd months and in Fort Worth in the even months.

Texas Radiological Society.—Secretary-Treasurer, R. P. O'Bannon, M.D., 650 Fifth Ave., Forth Worth 4.

VIRGINIA

Virginia Radiological Society.—Secretary, E. Latan Flanagan, M.D., 215 Medical Arts Bldg., Richmond 19.

WASHINGTON

Washington State Radiological Society.—Secretary-Treasurer, Thomas Carlile, M.D., 1115 Terry Ave., Seattle. Meetings fourth Monday of each month, October through May, at College Club, Seattle.

WISCONSIN

Milwaukee Roentgen Ray Society.—Secretary-Treasurer, C. A. H. Fortier, M.D., 231 W. Wisconsin Ave., Milwaukee 3. Meets monthly on second Monday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—Secretary, S. R. Beatty, M.D., 185 Hazel St., Oshkosh. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society in September.

University of Wisconsin Radiological Conference.—Meets first and third Thursdays 4 to 5 P.M., September to May, inclusive, Room 301, Service Memorial Institute, 426 N. Charter St., Madison 6.

CANADA

Canadian Association of Radiologists.—Honorary Secretary-Treasurer, J. W. McKay, M.D., 1620 Cedar Ave., Montreal.

La Société Canadienne-Française d'Electrologie et de Radiologie Médicales.—General Secretary, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets on third Saturday of each month.

CUBA

Sociedad de Radiología y Fisioterapia de Cuba.—Offices in Hospital Mercedes, Havana. Meets monthly.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Passage of Contrast Substances Through the Hypopharynx. Karl Søndergaard. Acta radiol. **26:** 222–224, Jan. 22, 1945. (In English.)

In order to establish a norm for deglutition, a study of swallowing of thick and thin media was undertaken. In no normal subject was there any retention of liquid medium in the valleculae, but with thick media retention up to thirty minutes was observed. In the presence of paralysis, retention was also observed, but it can be considered significant only when it lasts more than thirty minutes; other signs are of greater diagnostic importance.

LEWIS G. JACOBS, M.D.

Diagnosis and Treatment of Strictures of the Aqueduct of Sylvius (Causing Hydrocephalus). Walter E. Dandy. Arch Surg. **51:** 1–14, July–August 1945.

Strictures of the aqueduct of Sylvius (the iter) are congenital maldevelopments characterized by replacement of the channel by glial tissue, resulting in internal hydrocephalus. In infants the diagnosis is simple and fairly reliable; if the phenolsulfonphthalein test shows obstruction in the ventricular system and the inion (external occipital protuberance) is low, the obstruction is at the aqueduct. If the inion is high, the obstruction will be at the foramina of Magendie and Luschka. The altered position of the inion is due in the latter case to enlargement of the contents of the posterior fossa, and in the former to depression of the tentorium.

Strictures of the aqueduct in older children and adults produce few localizing signs, and ventriculography may be required for differentiation from tumors without signs of localization. Filling of the aqueduct and anterior part of the fourth ventricle excludes a stricture, but air shadows showing obstruction in the aqueduct may be due either to stricture or tumor. In such cases cerebellar exploration has usually been done. It is now possible, however, in most cases to reach a correct diagnosis by a study of the shape of the air shadow as disclosed by ventriculography, provided filling of the ventricular system ahead of the obstruction is complete. A triangular or funnel-shaped shadow is typical of stricture. Occasionally an obstruction due to a diaphragm may lead to confusion, but this is rare. Even ventriculography may be unnecessary and a diagnosis may be established on the basis of the height of the inion, determined preferably by roentgen examination. As suggested above, with a posterior fossa tumor the inion will usually be higher than normal. If, however, the head is oversize, the sutures are separated, and there is evident hydrocephalus, *without* elevation of the inion, a diagnosis of stricture of the aqueduct is highly probable. The author was able to make a diagnosis on this basis in 5 cases.

Treatment is by third ventriculostomy, through a lateral approach. In patients over one year of age good results can almost always be secured, although sometimes reoperation may be necessary. In the author's series of 29 patients in this age group, 24 were living and well, 4 of these with some degree of mental retardation. In patients under one year the chance of a good result is much less, a possible reason being the failure of the subarachnoid spaces to reopen after release of the pressure. Of 63 patients in this age group who were operated upon, 21 were known to be still alive. The hydrocephalus was cured in 12, but only 5 of these had a normal or nearly normal mentality. For this reason, operation is considered inadvisable in infants with a head circumference over 50 to 52 cm.

LEWIS G. JACOBS, M.D.

THE CHEST

Experiences with the Photoroentgen Method in Chest Surveys: Analysis of 156,000 Examinations. Archie Fine and T. B. Steinhausen. Ohio State M. J. **41:** 709–710, August 1945.

The authors have reviewed 156,000 examinations of prospective aviation cadets. Examinations were made by the photoroentgen method, with 4 × 5-inch films, and suspicious lesions were restudied on 14 × 17-inch films. The smaller films were of excellent quality, and the authors feel that for screening purposes a pair of stereoscopic 4 × 5-inch films is as satisfactory as a single 14 × 17-inch film. [With this conclusion all will not be in agreement. One frequently hears the opinion expressed that in the reading of chest films, the single 14 × 17-inch film often brings to the eye lesions not so quickly or readily seen when peering into the stereoscope, the stereoscopic films being favored for additional approach to certain lesions previously discovered.] The incidence of tuberculous and non-tuberculous lesions in the group examined is given in tabular form.

PERCY DELANO, M.D.

Discussion on Modern Conceptions of Industrial Lung Disease. Charles L. Sutherland, Richard Fawcitt, and John Craw. Proc. Roy. Soc. Med. **38:** 519–534, July 1945.

Sutherland opens this discussion of pneumoconiosis, quoting from the Annual Report (for 1943) of the Senior Medical Inspector of Factories: ". . . . Admittedly, with the exception of silicosis and asbestosis, we are only touching on the fringes of the pneumoconioses. . . . Exposure to an industrial dust . . . does not necessarily imply the existence of a pneumoconiosis, or disease, or present or future disablement, any more than the discovery of asbestosis bodies in the sputum by itself determines anything but exposure to asbestos dust, and that, not necessarily to a significant degree."

A distinction is made between pulmonary fibrosis due solely to free silica, which is sometimes given the name of "classical silicosis," and the changes produced by mixed dusts. The characteristic lesion of classical silicosis is the so-called silicotic nodule, composed of whorled collagenous tissue, containing some dust in its interstices but more aggregated on its periphery. These nodules are scattered unevenly throughout the lungs, producing the familiar "snowstorm effect" in the film. Between the nodules there may be some haziness, but no striations are ordinarily discernible. Actually the nodule represents to some extent a final result, inasmuch as it marks the encapsulation of the noxious silica dust, though radiologically nodulation is the first pathognomonic evidence of the disease. The South African Miners' Phthisis Medical Bureau recognizes "well marked linear striation" and "increased arborization" as radiologic evidence of a prenodular

stage, but these findings are not usually accepted in England and America.

Sutherland considers every case of silicosis as potentially tuberculous and stresses the importance of study of all films for signs of infection.

Coal miners are exposed to a variety of dusts. Three types of lung changes are recognized: reticulation, nodulation, and massive fibrosis. Silica probably plays a large part in the production of these lesions, although its action is modified by other dusts. Massive fibrosis has been variously ascribed to: (1) blocking of the lymphatics; (2) coalescence of nodules; and (3) infection. A fourth factor may be irritation.

Asbestosis is not produced in the same way as silicosis, for finely ground asbestos dust has been shown experimentally to have no irritative effect. Owing to the size and shape of the particles, there is damage to the bronchi, leading to dilatation; the pleura is thickened and adherent at its base, and there is also an interstitial fibrosis accompanied by emphysema. Definite x-ray changes are described as a ground-glass appearance of the lung parenchyma with a fine stippling.

Fawcitt emphasizes, as does Sutherland, the importance of co-operation between the radiologist and clinician and an exhaustive occupational history for the diagnosis of pneumoconiosis. He stresses, also, the necessity of careful radiographic technic, since "the x-ray picture of reticulation may be produced in the normal way by change in technique." He also contrasts the effects of organic and inorganic dusts. A series of illustrations is presented showing pneumoconiosis in hematite iron ore workers, illustrating individual variations in the process and some of the pitfalls in differential diagnosis. Hematite ore dust is of the radiopaque type and may be demonstrated in the lungs after a brief period of employment, though disease is not necessarily present.

Craw devotes his part in the discussion to a correlation between the radiologic findings in hematite ore workers and the pathological anatomy. He makes the point that the dense radiological shadows are due to the simple accumulation of particulate hematite, and that there is no stimulation of collagenous fibrosis and practically no increase in reticulin fibers. He concludes, also, that nodulation without massive fibrosis is a rare condition; that large-sized classical nodulation occurs only in the presence of established tuberculosis and is always associated with solid fibrotic masses; that the fibrotic response in the lungs bears no relationship to the total amount of silica or hematite present.

PERCY J. DELANO, M.D.

Carbon Tetrachloride Poisoning. A Report of Twenty Cases with One Death. S. M. Dillenberg and C. M. Thompson. Mil. Surgeon **97:** 39–44, July 1945.

Twenty cases of carbon tetrachloride poisoning are reported. Two men worked with this solvent in a confined compartment on a submarine, without adequate ventilation; the others inhaled the fumes while in or near the compartment over a period of two days. The initial symptoms in all 20 cases were headache, malaise, backache, anorexia, nausea, and vomiting. Nine patients with gastro-intestinal symptoms only were treated aboard the submarine tender and recovered without complications in four days. Albuminuria was present in 11 cases and these patients were admitted to the dispensary. Seven men recovered in a week without untoward sequelae; the others were critically ill, and one died. These cases are described in detail.

The 4 severely ill patients presented a typical toxic nephrotic syndrome, with puffiness and swelling of the soft tissues of the face, hands, and feet. Two patients exhibited the waxy pallor and facies of nephrosis. All 4 patients had retention of nitrogenous waste products in the blood stream. Despite the signs of kidney damage, no red blood cells were found in the urine. In contradistinction to cases of carbon tetrachloride poisoning recorded in the literature, no clinical evidence of liver damage was shown by these patients. In no case was the liver palpable or tender at any time, and none of the patients was jaundiced. One of the most prominent physical findings was severe flame-like subconjunctival hemorrhages which slowly disappeared over a period of four weeks.

Chest x-ray findings in the 4 serious cases varied from a mild prominence of all lung markings in one patient to complete consolidation of all five lobes in a man in whom acute pulmonary edema developed after apparent improvement. This complication occurred nine days after exposure, and the patient died despite all treatment. Roentgenograms are reproduced.

A Case of Primary Lung Cancer, Presumably Arisen from an Old Tuberculous Cavern. Gregers Thomsen and Sv. A. Chrom. Acta radiol. **26:** 230–238, Jan. 22, 1945. (In English.)

A case report of a "squamoepithelial" carcinoma of the right upper lobe of the lung which probably arose in an old tuberculous cavity. The correct diagnosis was not made until necropsy, due to the confusing mixture of signs of tuberculosis and tumor. The possible role of tuberculosis in the development of cancer is discussed, and various writers are quoted.

LEWIS G. JACOBS, M.D.

Tumor of the Lung Due to Cryptococcus histolyticus (Blastomycosis). B. A. Dormer, J. Friedlander, F. J. Wiles, and F. W. Simson. J. Thoracic Surg. **14:** 322–329, August 1945.

Certain yeast-like fungi, the blastomyces, may produce local lesions involving skin and bones or may become generalized, producing lesions of the internal organs, most commonly the lungs. Among the organisms causing blastomycosis is the so-called Cryptococcus. *Cryptococcus capsulatus* (Darling) produces the fatal histoplasmosis. *Cryptococcus histolyticus* is the cause of a not uncommon form of meningitis. No previous report of pulmonary tumor due to the blastomyces could be found.

The authors' patient was a 12-year-old boy who had a large, well defined mass in the right mid-lung field, demonstrable roentgenographically. It was removed surgically and found to be hard, fibrous, and slightly lobulated. It was easily enucleated from the lung and weighed 1 1/2 pounds. Microscopically the picture was that of a granuloma with *Cryptococcus histolyticus* found readily in the tissue. A meningitis developed postoperatively which did not respond to ordinary drugs but cleared up with potassium iodide. The spinal fluid was injected into the lung of a guinea-pig, which died on the fifty-second day. The guinea-pig's lung showed a chronic interstitial pneumonitis and multiple yeast-like bodies morphologically identical with *Cryptococcus histolyticus.*

HAROLD O. PETERSON, M.D.

Tularemic Pneumonia. Review of American Literature and Report of 15 Additional Cases. Byron M. Stuart and Roscoe L. Pullen. Am. J. M. Sc. **210:** 223–236, August 1945.

Twenty-one cases of tularemic pneumonia (6 previously reported) are summarized, bringing the total number recorded in the American literature to 268. In 115 of these a definite history of contact with animals was obtained, rabbits being implicated in 92. In 171 cases the tularemia was of the ulceroglandular, oculoglandular, or glandular type, and in 97 of the typhoidal type. Reports from various sources indicate that pneumonia is more common in the typhoidal type. Pulmonary involvement has been attributed by some to hematogenous dissemination and by others to inhalation of the organisms.

The 95 autopsy reports in the literature on patients dying with tularemia showed lesions of tularemic pneumonia in 69, an incidence of 72.6 per cent in fatal cases. The most frequent pulmonary involvement in these cases was a lobular or a confluent lobular pneumonia affecting one or more lobes. The nodules may show caseous necrosis, and actual cavities have been observed. An accompanying pleural reaction occurs in about half the cases of tularemic pneumonia.

In tularemia of the ulceroglandular, oculoglandular, or glandular type the pneumonic symptoms may follow from one or two days to many months after the development of the localized infection. In the typhoidal cases the infection appears to originate as a primary pneumonia. In general, pulmonary symptoms are less severe than those associated with other primary forms of pneumonia. The fever curve is spiking in character, while the pulse rate is relatively slow. The physical findings are usually those of an atypical pneumonia. Even though the pleuropulmonary involvement is demonstrable roentgenographically, the physical examination in some patients may reveal nothing of significance.

The most consistent roentgenographic features are enlarged and nodular hilar shadows usually occurring early in the disease. Bihss and Berland (Radiology **41:** 431, 1943) thought that the non-typhoidal cases usually showed hilar adenopathy with subsequent involvement of the lung parenchyma or the pleura, while in the typhoidal cases parenchymal involvement might not be preceded by hilar adenopathy. Abscess cavities are demonstrated occasionally.

In typical cases of tularemia the diagnosis may be made from careful clinical and roentgenologic investigation. Only the demonstration of *B. tularense* in the upper respiratory tract, however, establishes the tularemic nature of the pulmonary lesions. In the absence of an occupational history, ulceration, and lymph node involvement, the diagnosis of tularemia rests upon the laboratory findings, especially agglutination tests, though these cannot be relied upon until after the second week of the disease, and in fulminating infections a positive test may be delayed or may never be present. Material secured by lung puncture or from secretions or autopsy material may be inoculated into small animals with consistently reliable results.

Tularemic pneumonia may be mild and transient, and, except for roentgenography, may go unrecognized. On the other hand, pulmonary involvement may contribute largely to the death of the patient. Pneumonia, like tularemic peritonitis or pericarditis, is of grave prognostic significance, especially if bilateral. The pneumonia may last from a few days to several weeks. When the duration is longer than three weeks, a complication such as an abscess, secondary infection, or fibrosis should be suspected.

Unless there is evidence of secondary infection, the treatment is largely supportive or symptomatic.

BENJAMIN COPLEMAN, M.D.

Loeffler's Syndrome Associated with Creeping Eruption (Cutaneous Helminthiasis). D. O. Wright and Edwin M. Gold. J.A.M.A., **128:** 1082–1083, Aug. 11, 1945.

Loeffler's syndrome consists of the triad of transient and migratory pulmonary infiltration, paucity of symptoms and physical signs, and peripheral eosinophilia. It is thought to be an allergic phenomenon and has been reported associated with tuberculosis, *Ascaris* infection, trichinosis, asthma, Malta fever, *Endameba histolytica* infection, and pollinosis. Wright and Gold state that cutaneous helminthiasis represents an additional etiologic factor. This opinion is based upon observations of nine patients in whom roentgenologically visible transient pulmonary infiltration developed during the course of the nematodal skin infection.

JOHN F. HOLT, M.D.
(University of Michigan)

Production of Growth by the Action of the Pituitary Gland on the Vascular and Hemopoietic Systems: Interrelationship Between the Lungs and the Pituitary Gland. Robert C. Moehlig. Am. J. Roentgenol. **54:** 109–127, August 1945.

Evidence is presented to support the view that the pituitary gland produces growth by the formation of blood vessels and by supplying blood to the tissues; that there is a reciprocal relationship between the lungs with their vital functions of oxygenation and respiratory water metabolism and the pituitary gland. Some of the points made by the author are as follows:

(1) The production of localized gigantism has been seen in association with arteriovenous fistula of an extremity, showing that it is by an increase in the vascular development with consequent increase in blood supply that growth takes place. Assuming that the pituitary gland induces growth by developing the circulatory system of the body and hemopoiesis, there is no need to assume the presence of specific hormones or polyhormones since all endocrine glands would be affected by this mechanism as well as the body as a whole.

(2) Congenital hypopituitarism results in a defective development of the vascular system with a decrease in blood supply to the tissues, resulting in dwarfism. The dwarfism of cretinism and other forms of dwarfism as well can be explained on this same basis.

(3) The eosinophilic cells of the pituitary probably are responsible for vascular development, while the basophilic cells are responsible for hemopoiesis.

(4) Primary diseases of the lungs, such as cancer, chronic pulmonary suppuration, and chronic pulmonary osteoarthropathy, are often associated with pituitary chromophil hyperplasia. It is suggested that the lung disease produces an inflammatory reaction which calls for vascularization, oxygenation, and hemopoiesis, and this in turn results in a compensatory hyperplasia of the pituitary chromophil cells.

(5) A close relationship has been shown between the posterior pituitary lobe and the vascular system by pharmacologic effects.

L. W. PAUL, M.D.

Spontaneous Mediastinal Emphysema. M. H. Stein. New York State J. Med. **45:** 1659–1662, Aug. 1, 1945.

The symptoms produced by spontaneous mediastinal emphysema may closely simulate those of coronary occlusion, pericarditis, pulmonary embolism, and dissecting aneurysm of the aorta. The differential diagnosis, therefore, is of importance. The usual predisposing causes are trauma to the chest, unusual pulmonary effort, such procedures as induction of pneumothorax, pneumoperitoneum, tracheotomy, bronchoscopy and neck dissections, and infections such as tuberculosis, pneumonia, diphtheria, and influenza. Most cases occur in young adult males.

The rupture of pulmonary alveoli allows air to escape into the surrounding pulmonary tissue, whence it follows fascial planes to the hilus of the lung and into the mediastinum. There it infiltrates the tissues between the heart and anterior chest wall, producing severe pain, often simulating angina particularly since the radiation is identical. The pain may be aggravated by deep breathing, turning the head or body, or by swallowing. If the air continues to arrive in the mediastinum and is trapped there, cardiac compression may produce serious complicating effects. Fortunately this does not occur often, as the ruptured alveolus is usually sealed off fairly promptly and in most cases the air is absorbed over a period of several days. In some there is a concomitant spontaneous pneumothorax which is almost invariably over the left upper lobe. This tends to compress the lung and often produces a self-limiting effect on the emphysema. The air in the mediastinum may leak into the neck, chest wall, shoulders and arms, producing subcutaneous emphysema there. It may descend through the diaphragm into the retroperitoneal space and may even go into the abdominal wall and down over the lower extremities.

The most significant diagnostic finding is a peculiar sound heard over the left border of the sternum on systole, variously described as a crunching, bubbling, crackling, crepitant, or clicking sound. It is heard best with the patient holding his breath at the end of expiration. Cardiac dullness is partially or completely obliterated. Usually no significant constitutional symptoms are present. The electrocardiogram is usually normal. Other laboratory tests are commonly negative.

X-ray studies of the chest may show a collection of air in the anterior mediastinum between the heart and chest wall on the lateral view or parallel to the heart border in the anteroposterior view, but a negative x-ray picture does not invalidate the diagnosis. The associated pneumothorax will be apparent when present. [The author does not note that air in the neck, chest wall, and shoulders should be easily recognizable radiographically.]

In most cases, the prognosis is good, as the air is gradually absorbed without surgical intervention. In severe cases, with compression of the heart and great vessels, aspiration of the trapped air may be needed.

Two cases of spontaneous mediastinal emphysema are reported. BERNARD S. KALAYJIAN, M.D.

Occlusion of the Superior Vena Cava Due to Syphilitic Mediastinitis. Collateral Circulation After Nineteen Years. Frederic D. Zeman. J. Thoracic Surg. **14:** 330–338, August 1945.

A case of occlusion of the superior vena cava attributable to syphilitic mediastinitis with secondary venous thrombosis is recorded. The patient was first seen in 1926, at the age of 49, with a typical picture of superior vena cava obstruction of six months' duration, clinical and laboratory evidence of syphilis, and a history of chancre as a young man. He was actively treated for syphilis and showed some clinical improvement. Eighteen years later (November 1943) he again presented himself, complaining of precordial pain and dyspnea on exertion, which are attributed to hypertensive cardiovascular disease. He now had large varicose veins over the thorax, but the only symptoms referable to the vena cava obstruction were a sense of fullness and throbbing of the head on bending over. The venous pressure in the arms was elevated and could be made to rise by constricting the thorax; circulation time from the arms was delayed. The patient was still alive at the time of the report and seemed well adjusted to the obstruction in the superior vena cava.

The roentgenograms as reproduced do not show very clearly the changes described. Diodrast was injected in the cubital veins of both arms, and following this the collateral circulation on the chest wall was fairly well demonstrated. The obstruction in the vena cava is not satisfactorily shown. An obstruction in the left subclavian vein is seen quite clearly.

From a review of the literature it is evident that obstruction of the superior vena cava is unusual, and thrombosis of that vessel is an even greater rarity. In the reported cases syphilis was a common cause of both thrombosis and external constriction of the large veins.

From a clinical point of view the presence of transitory edema of the head and neck observable on rising in the morning and disappearing slowly in the upright position is pathognomonic of venous obstruction in the upper mediastinum. HAROLD O. PETERSON, M.D.

Value of Kymography for the Differential Diagnosis Between Aneurysm of the Aorta and Mediastinal Tumor. Bryan Fabricius. Acta radiol. **26:** 89–98, Jan. 22, 1945. (In English.)

The author studied 29 cases of aortic aneurysm and 11 of mediastinal tumors kymographically to determine the accuracy with which the two conditions could be distinguished. He concludes that it is not possible in all instances to make this distinction, as some aneurysms fail to show linear rarefactions and characteristic pulsation, while these features may be present in tumors which are highly vascular and in intimate connection with the aorta. LEWIS G. JACOBS, M.D.

Ebstein Type of Tricuspid Insufficiency: Roentgen Studies in a Case with Sudden Death at the Age of Twenty-Seven. Donald deF. Bauer. Am. J. Roentgenol. **54:** 136–144, August 1945.

Ebstein's disease of the heart is a rare congenital malformation consisting essentially of downward displacement of the tricuspid valve in an otherwise completely developed heart. The right auricle is greatly enlarged and the foramen ovale is usually patent. The true right auriculoventricular ostium is enlarged. A case is presented in detail, the seventeenth in the literature and the fourth in which sudden death occurred. The patient was 27 years old at the time of death. The roentgen evidences of tricuspid insufficiency were: massive enlargement of the cardiac shadow to the right and left in the absence of pulmonary congestion and in the presence of vigorous pulsations; a prominent upper medias-

tinal shadow with widened superior vena cava; enlargement of the right atrium and ventricle and actual difficulty in visualizing the small left ventricle.

L. W. PAUL, M.D.

Myocardial Infarction—Roentgen Diagnosis. Leo H. Garland. U. S. Nav. M. Bull. **45:** 89–96, July 1945.

In most instances the clinical diagnosis of myocardial infarction is reasonably reliable. However, in cases in which the history or electrocardiographic findings are inconclusive or not in agreement, additional data are desirable. In these cases fluoroscopy, roentgenography, and roentgenkymography may be useful.

Fluoroscopic detection of myocardial damage is dependent on localized abnormalities of curvature or motion of the cardiac silhouette. Flattening and diminished excursion of the ventricular wall are the most common findings. Bulging and paradoxical pulsation are less frequently seen. Roentgenograms are useful for determination of heart size and shape.

The technic of and indications for roentgenkymography are discussed. Positive kymographic findings in myocardial infarction include (1) localized diminution or absence of pulsation, (2) systolic expansion or paradoxical pulsation, and (3) partial systolic expansion or marked diastolic irregularities. Negative findings do not exclude the possibility of infarction but appear to occur in less than 30 per cent of cases. The degree of kymographic abnormality usually parallels the extent or severity of infarction.

A case is reported in which myocardial infarction was correctly diagnosed on the basis of kymographic findings, in spite of negative electrocardiographic and indefinite clinical evidence. The diagnosis was verified at autopsy.

H. H. WRIGHT, M.D.

Dextrocardia with Situs Inversus Complicated by Chronic Rheumatic Aortic and Mitral Endocarditis. George W. Parson. Ann. Int. Med. **23:** 102–107, July 1945.

Dextrocardia complicated by acquired organic heart disease must be rare, for Abbott and Russek (Am. J. M. Sc. **204**: 516, 1942), reporting a case with calcareous aortic stenosis, listed only five previous case reports. In these, the acquired lesions were mitral stenosis, hypertensive heart disease, coronary thrombosis, hypertensive and coronary heart disease, and syphilitic aortitis and aortic insufficiency. Apparently no instance of dextrocardia complicated by combined aortic and mitral endocarditis has been previously recorded.

The author's patient was a 24-year-old white woman, in whom dextrocardia had been recognized at the age of one month. Her infancy, childhood, and early adult life had been normal; she had married at the age of 18 and had two children, 3 1/2 years and 14 months old. There was a history of an acute febrile illness at the age of 21, with red, swollen, painful joints. During the patient's second pregnancy a cardiac lesion was recognized, but apparently no myocardial failure developed. Dyspnea and edema occurring post partum responded to digitalis and diuretics. The chief complaints on admission were pain in the right side of the chest and "throbbing of the heart."

The patient appeared weak and chronically ill. Blood pressure was 95 to 105 mm. Hg systolic and 50 mm. diastolic. The temperature was not elevated. The heart rate was 110 per minute. The cardiac apex impulse was visible and palpable well outside the midclavicular line, 11 cm. to the right of the mid-sternal line. On auscultation a loud harsh systolic aortic murmur and a distinct diastolic aortic murmur were present. The first mitral sound was loud and crescendo.

Fluoroscopic and roentgenographic examination revealed a transposition of the heart, moderate cardiac enlargement, a small right-sided aortic knob, enlargement of the conus of the right ventricle, increased markings in the lung fields, and enlarged hilar shadows. The left leaf of the diaphragm was higher than the right. In the left oblique view the significant finding was a dorsal displacement of the barium-filled esophagus by an enlarged left auricle. A transposition of the stomach and colon was demonstrated by fluoroscopic and roentgenographic examination following a barium meal.

The diagnosis of endocarditis was based on the history of the acute febrile illness resembling rheumatic fever and the physical findings. A pronounced systolic basal thrill and a loud, well transmitted systolic and a distinct diastolic aortic murmur in a young person are indicative of chronic rheumatic aortic endocarditis. The fluoroscopic and roentgenographic findings of enlargement of the conus area of the right ventricle and of enlargement of the left auricle are the usual structural changes demonstrable in mitral stenosis. The broad, notched P-waves in Leads I and II of the electrocardiogram were evidence of left auricular strain, and inverted T-wave changes in Leads II and III suggested right ventricular strain. Both of these are produced by mitral stenosis.

STEPHEN N. TAGER, M.D.

On the Relationship between the Heart Volume and Various Physical Factors. Gunnar Biörck. Acta radiol. **25:** 372–378, Sept. 20, 1944. (In English.)

Among the different correlation factors for the evaluation of the heart volume, body height, body weight, body surface, and basal metabolism are most frequently considered. Minor factors are blood volume, general muscular development, and volume of the heart muscle proper. In a study of 136 persons ranging in age from thirteen to seventy years without serious general disease or circulatory disturbances, body height was found to be unsuitable as a correlation factor for the estimation of the relative heart volume. The question whether body weight or body surface is preferable as a correlation factor was not conclusively answered by the observations, the difference between the results obtained by the two methods being insignificant. The dependence of the heart volume on the body metabolism appeared not entirely reliable when the metabolism was calculated by means of oxygen consumption. The relationship between body weight and heart volume was found to be especially misleading in cases of marked obesity. In such persons the correlation of heart volume to body surface appears to be more acceptable.

ERNST A. SCHMIDT, M.D.

THE DIGESTIVE SYSTEM

Benign Tumors of the Esophagus. Report of Three Cases. Ralph Adams and Walter B. Hoover. J. Thoracic Surg. **14:** 279–286, August 1945.

Benign esophageal tumors are rare, a complete review of the literature revealing only 94 cases. The authors

add 3 more cases and tabulate the collected series as to microscopic diagnosis. Polyps formed the largest group, 35 cases. The next largest group was made up of the myomas and leiomyomas, 16 cases. There were 8 fibromas, 9 papillomas, 6 lipomas and lipomyomas, and 6 cysts. Other tumors of less frequent occurrence included aberrant thyroid, adenoma, hemangioma, myxofibroma, neurofibroma, osteochondroma, and giant-cell tumor.

Roentgenograms illustrate the three case reports, but with one exception the reproductions are unsatisfactory. The surgical problems involved in the three cases are discussed in detail. The cases were handled differently, but good results followed operation in each instance.

The roentgen diagnosis of these tumors does not seem to present any particular difficulty, with the exception of intramural extramucosal lesions, where it might be difficult to decide whether the mass were entirely extrinsic to the esophageal wall. Barium will flow evenly around the intraluminal tumors, producing a picture in strong contrast to the narrow irregular channel of a carcinoma.

HAROLD O. PETERSON, M.D.

Physiological Delay at the Cardia. Franz Sørensen. Acta radiol. **26:** 225–229, Jan. 22, 1945. (In German.)

Eighty-five patients with no symptoms referable to the esophagus were examined after ingestion of a contrast meal to determine the normal opening time of the cardiac sphincter. In 63 no delay at all was observed at the cardia; of the other 22, 13 showed a delay of half a minute or less, 4 a delay of half a minute to a minute and a half, and 1 a delay of twenty-five minutes. All but 3 of those with delay were women. In 3 patients, including the one with twenty-five minutes delay, subsequent examination showed organic disease of the stomach as an underlying cause. Fourteen of the healthy individuals with delay were re-examined fasting; 13 then showed no delay, and the amount of retardation in the other was lessened.

LEWIS G. JACOBS, M.D.

Chronic Hypertrophic Antrum Gastritis. Julian Arendt. Ann. Surg. **122:** 235–252, August 1945.

The author reviews the diagnostic signs of antral gastritis and points out the deceiving similarity to malignant growth. He emphasizes the importance of a complete history referable to the upper gastro-intestinal tract. Golden is quoted as stating that gastritis is frequently accompanied by disturbance in motility, antral spasm, and prepyloric narrowing, as well as hypertrophy of the pyloric muscle. In view of the above statements, the author considers visible pyloric hypertrophy or antral spasm in an adult helpful in the diagnosis of chronic hypertrophic gastritis. A second sign is a change in the mucosal pattern, with swelling, stiffness, and deformity of the mucosal folds, yet without a break in their continuity. If there is a break in their continuity, ulceration is present and a malignant neoplasm is a good possibility. The author states that early opening of the pylorus with a deformed antrum is in favor of carcinoma, while delayed opening with a similar deformity is in favor of antral gastritis.

Seven cases are reported, but the diagnosis of hypertrophic gastritis might be questioned in some of these.

SYDNEY F. THOMAS, M.D.

Invagination of the Stomach: A Case Diagnosed by Means of Roentgen Examination. Kai Dohn and Börge Faber. Acta radiol. **26:** 56–68, Jan. 22, 1945. (In English.)

A case of gastro-gastric intussusception due to a pedunculated leiomyoma, diagnosed roentgenologically, is reported. Although there was spontaneous reduction in eleven days, the patient died of intercurrent infection. Twenty-four other cases in the literature are reviewed, and references to most of these are included. The condition is usually due to a benign pedunculated tumor. In 6 of the 14 cases studied by roentgenograms, the diagnosis could be established by this means. Clinically the condition mimics pyloric obstruction; a palpable tumor, often associated with bloody vomiting, melena, or anemia, is a common finding.

LEWIS G. JACOBS, M.D.

Solitary and Multiple Carcinomas of the Upper Alimentary Tract: Their Location, Age and Sex Incidence, and Correlation with the Plummer-Vinson Syndrome. Aage Videbæk. Acta radiol. **25:** 339–350, Sept. 20, 1944. (In English.)

In a study of 1,313 cases of cancer of the upper alimentary tract (extending from the lips to the gastric antrum), the author found significant differences in the site of predilection for the various sex and age groups. In women, tumors predominated in the postcricoid region, the posterior pharyngeal wall, the entrance to the esophagus and its cervical portion. In men, tumors most often occurred in the lower lip, at the base of the tongue, in the piriform sinus, and the lower esophagus. In other regions of the upper alimentary tract, there was no significant difference in tumor occurrence between the two sexes, nor was there any appreciable difference with regard to histologic characteristics which would explain the differences in radiosensitivity in the sexes.

The Plummer-Vinson syndrome was seen less frequently in Denmark than in Sweden, a fact which probably accounts for the considerably smaller percentage of women suffering from upper alimentary tract cancer in Denmark. Multiple carcinoma was observed slightly more often in men than in women. Apparently the upper alimentary canal shows a particular tendency to the occurrence of successive carcinomas.

ERNST A. SCHMIDT, M.D.

A Search for Symptomless Gastric Cancer in 500 Apparently Healthy Men of Forty-Five and Over. Morris E. Dailey and Earl R. Miller. Gastroenterology **5:** 1–4, July 1945.

In an attempt to discover minimal gastric malignant lesions, a survey was made of 500 white men of forty-five or over, who were free of digestive complaints other than gas or constipation. Anyone who followed an altered diet, even rarely took antacids, or gave a history of gastro-intestinal distress was excluded from the series. All were examined by barium meal and fluoroscopy, and any individual whose stomach showed a hint of abnormality returned for a complete gastro-intestinal series with films. A considerable number of non-gastric abnormalities were revealed and these are listed. The most common cause for requesting films was a prepyloric deformity. Twenty-nine men were suspected of having gastric disease on fluoroscopic examination; roentgenograms were normal in 23 of these cases, probably normal in 3; one patient was

found to have a gastric ulcer; one, antral gastritis; one a suspected antral polyp.

The authors conclude that a survey of the general population in search of gastric cancer is not worth while. Even if a lesion is found, follow-up studies are all but impossible. Mortality rates, autopsy statistics, and hospital census data do not give a full picture of the incidence of silent gastric cancer. Studies of selected groups, as those with pernicious anemia, should be expanded, as this seems a profitable approach to the problem. Since all individuals with the slightest symptoms were excluded from this survey, the authors' results in no way detract from the view that even mild dyspepsia in older persons demands prompt and adequate investigation.

Some Cases of Intestinal Tuberculosis in Phthisics, with Reference Especially to the Prognosis. Sv. B. Larsen. Acta radiol. **26:** 117–132, Jan. 22, 1945. (In English.)

The author studied 32 cases of pulmonary tuberculosis in which a diagnosis of secondary intestinal tuberculosis was based on laboratory and roentgenologic proof. Twenty-one patients were re-examined after intervals of two to eight years, and of these only 3 showed an entirely normal picture, although at the time most of the groups were asymptomatic, with their pulmonary lesions arrested. LEWIS G. JACOBS, M.D.

Significance of Cannon's Point in the Normal and Abnormal Functions of the Colon. Julian Arendt. Am. J. Roentgenol. **54:** 149–155, August 1945.

A point in the proximal mid-third of the transverse colon, corresponding to the contraction ring in the large bowel of animals first described by Cannon, is also found in man and can be demonstrated roentgenologically. The point is visualized as a contraction ring or as the point where distinct changes in filling and contraction of the bowel occur. Thus it may be noted that the ascending colon and the first part of the transverse are contracted while the balance of the colon is of normal caliber, or *vice versa*. It is the author's belief that this is the pivotal point of a change in innervation between the vagus and the pelvicus and, on the sympathetic side, between the splanchnicus superior and inferior. For roentgen demonstration an antagonism between these neurological units is necessary. Spastic contraction of the distal unit is considered a frequent cause of spastic constipation. L. W. PAUL, M.D.

Periodic, Spontaneously Remittent Volvulus and the Symptoms in Cases of Colon Elongatum. Flemming Nørgaard. Acta radiol. **26:** 163–184, Jan. 22, 1945. (In English.)

Volvulus is often asymptomatic, especially if it involves a twist of 180° or less. Three cases are reported in which a periodic, spontaneously remittent volvulus was diagnosed radiologically. The symptoms were recurrent attacks of abdominal pain for years, occurring without obvious cause and relieved by lying down. Clinical findings were slight, but in all patients radiography showed a localized volvulus in an abnormally long loop of colon, without ileus; an enema or a change of position would straighten out the loop. A number of other cases of elongated colon are presented in which the author thought a similar condition had occurred. A case of volvulus of the sigmoid accompanied by a coprolith and marked secondary changes is also described. LEWIS G. JACOBS, M.D.

Radiologic Study of Cecocolic Invagination in the Adult. René-J. Gilbert and J. Garcia-Caldéron. Acta radiol. **25:** 251–268, Sept. 20, 1944. (In French.)

Basing their conclusions on a case of adenocarcinoma of the cecum described in detail, the authors discuss the various radiological phenomena important for the diagnosis of cecocolic invagination in the adult. Examination with the aid of both the barium meal and the barium enema is considered. It is possible to arrive at a general diagnosis of invagination by a barium meal study, but this method does not permit a differential diagnosis between the two anatomically different cecocolic types. The morphologic signs obtained after the barium meal are: (1) dystopia with ascending passage and dilatation of the terminal loop of the ileum, smooth or dentulated in outline and ending in a beak-like protrusion; (2) lack of visualization of the cecum and of a more or less extensive portion of the right colon and even the transverse colon; (3) narrow intestinal lumen (*défilé entérique*) with longitudinal striation, in extension of the above-mentioned "beak" of the terminal loop of the ileum and exactly following the axis of the colon; (4) lacunar dilatation of the colon by the invagination, the lacunae being bordered by an opaque margin and traversed by either fine mucous folds or dense haustral shadows, producing the so-called "accordion" appearance. Phenomena (1) and (2) may also occur in colocolic invagination. The combination of the phenomena (3) and (4) results in the so-called "five parallel bands" aspect, which is pathognomonic for intracolic invagination.

The signs observed during the barium enema examination may be divided into those seen during the process of filling, during the process of reduction, and after complete reduction. *During the process of filling*, one observes the arrest of the barium column in form of a cup (without diagnostic significance), in form of a figure 3, in form of a trident or, rather rarely, as a segmentary radiopacity of the central canal. In addition, the so-called "mantle lacuna" may be seen, due to the deeper penetration of the radiopaque medium along the sheath of the invagination. *During the process of reduction*, the more or less rapid disappearance of the lacuna is noted (similar in appearance to "the withdrawal of a piston from a syringe"). *After complete reduction* of the invagination, the cecal lacunar picture persists in the case of tumor. By air insufflation and compression the characteristics of the deformity (diminished caliber, sickle-shaped incurvation of the intussuscepted apex, etc.) may be determined. The terminal loop of the ileum will be filled with barium. On the other hand, retraction, festooning of the cecal fundus, and convergence of the mucosal folds may also be due to peritoneal adhesions.

In the differential diagnosis, ileocolic and colocolic invagination must be considered. Tumor, benign or malignant, is the most common cause of cecocolic invagination in the adult. ERNST A. SCHMIDT, M.D.

Roentgenological Manifestations of Amebiasis of the Large Intestine. A. Druckmann and S. Schorr. Am. J. Roentgenol. **54:** 145–148, August 1945.

On the basis of roentgen studies, amebiasis of the colon can be divided into two types:

(1) The diffuse type. The roentgenologic appearance is similar to that of idiopathic ulcerative colitis, from which it cannot be distinguished.

(2) The localized type. This has a more distinctive roentgen appearance and is characterized by: (*a*) the relative length of the stretch occupied by the filling defect of the colon; (*b*) the often multiple occurrence of obstruction of the lumen; (*c*) the incompleteness of the narrowing of the lumen as compared to malignant stenosis; (*d*) the insignificance or even absence of pain upon distention by the barium enema, in contrast to the acute pain of malignant stenosis; (*e*) the frequently gradual merging of the filling defect into the normal contours of the intestine; (*f*) the partial maintenance of elasticity of the intestinal wall, evidenced by widening of the lumen upon introduction of barium; (*g*) the more or less normal mucosal relief in the involved portion, and (*h*) the more or less complete restoration to normal after vigorous antiamebic treatment.

L. W. PAUL, M.D.

Two Cases of Internal Biliary Fistulae. Enar Brandel. Acta radiol. **25:** 333–338, Sept. 20, 1944. (In German.)

Internal biliary fistulae have been known for a long time and are, as a rule, easily recognized by radiography. Kehr reported a 5 per cent occurrence in his large material of gallbladder operations while Prévôt observed them only in 0.39 per cent of his autopsy cases. The most common causes of internal biliary fistulae are cholelithiasis, duodenal or gastric ulcers, and occasionally cancers. In about half of the cases there exists a communication between the gallbladder and the duodenum; in about one-third of the cases between the gallbladder and the colon; in about 10 per cent between the gallbladder and the stomach. Only in very rare cases do the fistulae involve the appendix, the thoracic cavity, the urinary tract, or the uterus. Due to the vagueness of symptoms, the clinical diagnosis without radiography is extremely difficult. Two cases diagnosed and observed by the author are described in detail.

ERNST A. SCHMIDT, M.D.

THE DIAPHRAGM

Traumatic Right Diaphragmatic Hernia: Case with Delayed Herniation of the Liver and Gallbladder. Clifford H. Keene and Benjamin Copleman. Ann. Surg. **122:** 191–196, August 1945.

Traumatic hernia rarely occurs through the right hemidiaphragm. The incidence as given by Hedblom (Ann. Int. Med. **8:** 156, 1934), on the basis of the literature, is 5 per cent. In a series of 857 traumatic hernias, he found the liver to be involved in only 14 (1.6 per cent).

In the authors' case, which followed a plane crash, films made immediately after the accident showed no herniation. About three months later, the patient began to have pain in the right lower thorax, which was worse after eating. Peristaltic gurgles were heard high in the right axilla. A chest film now showed a homogeneous shadow in the right lower thorax, while abdominal films failed to demonstrate the lower margin of the liver. A barium enema study showed the hepatic flexure to be unusually high in position. It was assumed, therefore, that the liver had migrated into the chest, and to confirm this impression, cholecystography was done. It revealed "a markedly elongated, narrow gallbladder, the fundus of which was directed upward toward the right axilla." At operation for repair of the hernia, the liver was found in the right thorax, lying completely upside down. The right hemidiaphragm was contracted and shrunken posteriorly and medially. The gallbladder was stretched into a long, thin, tubelike structure extending from the posterior-superior portion of the chest down into the abdomen.

The liver was rotated 180° into its normal position and the rent in the diaphragm was repaired after crushing the right phrenic nerve. Postoperative cholecystograms showed a normal appearing gallbladder.

[The shadow interpreted as the distorted gallbladder in the reproduction of the cholecystogram is not too convincing.—S.F.T.] SYDNEY F. THOMAS, M.D.

Four Cases of Diaphragmatic Intumescence. Aage Wagner. Acta radiol. **26:** 239–247, Jan. 22, 1945. (In English.)

The author reports 4 cases in which there was a pronounced upward bulge of the diaphragm at the right cardiophrenic angle. In 3 the diagnoses were, respectively, congenital short esophagus with hiatus hernia, subdiaphragmatic cyst, and diaphragmatic hernia containing liver tissue. The fourth case was thought to be a pericardial lipoma, but the diagnosis is unconfirmed.

LEWIS G. JACOBS, M.D.

THE MUSCULOSKELETAL SYSTEM

Osteomyelitis Caused by Granuloma Inguinale: Report of a Case with Cultivation of the Donovan Body in the Yolk Sac of the Developing Chick Embryo. Walter H. Sheldon, Ben R. Thebaut, Albert Heyman, and Margaret J. Wall. Am. J. M. Sc. **210:** 237–245, August 1945.

Although extragenital lesions of granuloma inguinale are not uncommon, skeletal involvement is rare. Such lesions are generally believed to be the result of contact infection, but the occasional occurrence of multiple widespread extragenital lesions has suggested a hematogenous dissemination. In support of a systemic disease, also, are the cases of bone lesions without the occurrence of skin ulcers.

A case of osteomyelitis due to granuloma inguinale is reported in a 43-year-old colored male. He struck his shin about six months before admission and sustained a bruise, which persisted. He injured the bruised area again and an ulcer formed. His knee subsequently became stiff. Three weeks before admission a small erosion of the penis adjacent to the corona was observed. The patient insisted that the ulcer on his leg had been present for a long time before the appearance of the penile lesion. The blood Kahn reaction was negative. The sedimentation rate was 125 mm. in one hour. The Ducrey and tuberculin skin tests were positive. The Frei test was negative, but the complement-fixation test for lymphogranuloma venereum was positive.

Roentgenograms of the leg showed a large bone defect, about 4 cm. in diameter, in the proximal portion of the tibia at the level of the tubercle. The cavity was surrounded by moderately sclerotic bone. There was irregular thickening of the adjacent periosteum. The other bones were normal except for a cystic area in the anterior portion of one of the ribs. The clinical impres-

sion was that the lesion was a tumor. Biopsies from the granulation tissue of the leg, and later from the penis, showed granuloma inguinale. Donovan bodies were isolated in pure culture by inoculation into yolk sacs of chick embryos of a portion of the biopsy material. Biopsy of the lesion in the rib showed no evidence of granuloma inguinale. Treatment consisted of Fuadin intramuscularly, and sulfonamide powder and tyrothrycin locally to the lesions in the leg and penis.

Only 4 other cases have been found in the literature in which the diagnosis was proved by histologic examination. There are recent reports of arthritic manifestations with extensive lesions in the joints of the hands and feet. Occasionally there has been noted an elevation of the serum globulin and the alkaline phosphatase.

BENJAMIN COPLEMAN, M.D.

On Reticulum Cell Sarcoma in the Bones. Thomas Rosendal. Acta radiol. **26:** 210–221, Jan. 22, 1945. (In English.)

The author discusses 4 cases of reticulum-cell sarcoma metastatic to bone and a fifth case of generalized periosteal reticulum-cell sarcoma, a condition not previously described. In 3 instances the lesions were osteolytic, in 1 osteoblastic, and in 1 there was vertebral collapse only. The prognosis under roentgen therapy is comparatively good, with some prospect for a permanent cure.

LEWIS G. JACOBS, M.D.

Malignancy of Giant Cell Tumors: A Study on Giant Cell Tumors and Allied Affections in Bone, with Reference Specially to Their Malignancy. Sigurd Ry Andersen. Acta radiol. **26:** 11–35, Jan. 22, 1945. (In English.)

This report covers 48 cases diagnosed as giant-cell tumor including all cases adequately examined at the Radium Center in Copenhagen and in the Finsen Institute between 1930 and 1943. Most cases were referred from other hospitals, and several were recurrences. One case (in the femur) was probably a primary osteogenic sarcoma, wrongly diagnosed. The other 47 were distributed as follows:

Giant-cell tumors in epiphyses of the long bones	11
Giant-cell tumors in short bones or soft tissues	3
Osteitis fibrosa in long bones	8
Osteitis fibrosa generalisata	3
Giant-cell tumor of upper jaw	1
Osteitis fibrosa of upper jaw	2
Epulis gingivae	19

The pathological picture was enormously varied, and the author was unable to distinguish by microscopy the cases which might be considered true neoplasms. In only one case (head of the right humerus) did malignant change occur, three years following roentgen therapy. This was confirmed by repeated microscopic study. The important point clinically is "that an osteogenic sarcoma in the beginning not infrequently may to the point of deception resemble a benign giant-cell tumor, and particularly that the roentgenologic pictures of the two conditions may be exactly alike; so that the possibility of the case being an osteogenic sarcoma cannot be excluded with certainty except on the basis of a histologic examination." Since occasional giant-cell tumors may become malignant, it is necessary to repeat the biopsy if new symptoms supervene. Unnecessary mutilating operations should be avoided. While it is not generally agreed whether surgery is the treatment of choice, the author leans in that direction. The use of both forms of treatment offers no advantage.

LEWIS G. JACOBS, M.D.

Cystic Forms of Cancer Metastases in Bone. Bengt Engfeldt. Acta radiol. **25:** 317–324, Sept. 20, 1944. (In French.)

Cystic cancer metastases of the bone are rare. According to Engfeldt, only 4 cases have been described in the medical literature: 2 following cancer of the breast, 1 following cancer of the esophagus, and 1 after cancer of the prostate. He adds a case following adenocarcinoma of the lung with mucous secretion. The metastases occurred in the spine, pelvis, right femur, tibia, sternum, and clavicles. The metastatic involvement gave rise to no symptoms and was discovered incidentally during a chest examination for cough and shortness of breath. The metastases ranged from pea to hazelnut size and occurred both as isolated lesions and in groups. The peculiar cystic character of these metastases is probably due to two factors: the abundant mucous secretion of the tumor cells and their tendency to slow and expansive growth. The walls of the metastatic cysts exhibited both osteoclastic and osteoplastic characteristics.

ERNST A. SCHMIDT, M.D.

Isolated Myeloma in a Fourteen Year Old Boy. Justus Kaufman. Am. J. Surg. **69:** 129–132, July 1945.

A case of isolated myeloma of the skull in a fourteen-year-old boy is presented. The chief complaint was persistent localized pain of two weeks' duration, in the right occipital region, and a suddenly enlarging mass in this area. Past illnesses were negligible with the exception of a severe trench mouth, three months previously. The only abnormal finding on examination was a cystic mass 3/4 inch in diameter over the right occipital bone. This was not freely movable and was tender to palpation. A roentgenogram revealed an area of bone rarefaction in this region, with a characteristic punched-out appearance. The skull was otherwise normal. Complete x-ray studies of the skeleton disclosed nothing further of significance.

At operation, as much of the tumor was removed as possible, and the edges of the bone were curetted. The histologic diagnosis was myeloma. Postoperatively a total of 1,755 r was administered through a small portal to the right occipital region in fractionated doses over a thirty-three-day period. The factors were 200 kv., 6 ma., 1 mm. Cu filter, 60 cm. distance. Complete epilation followed, but later there was a growth of new hair. Roentgenograms of the skull approximately four years after the removal of the tumor showed the defect in the skull almost completely replaced by bone. At that time the patient seemed well in every respect.

An isolated myeloma is an unusual finding, particularly in a young boy. Dr. James Ewing, who saw this patient, suggested that the severe mouth infection might have been an exciting factor in the production of the tumor. It is of interest that a first cousin of the patient died of myelogenous leukemia at the age of twelve.

Late Bone Lesions in Caisson Disease. Three Cases in Submarine Personnel. C. C. Michael James. Lancet **2:** 6–8, July 7, 1945.

Three men were examined twelve years after a single severe attack of "bends" as a result of being trapped for two and a half to three hours under increasing pressure in a submarine sunk in a collision to a depth of 120 feet. The men were of similar age and experienced the same conditions, but the bone lesions were much more severe in one case, probably because this man had struggled violently to open a stop-cock at the time of the accident. It is thought that the increased circulatory rate during the recovery period following his strenuous activity would tend to permit more rapid absorption of the gases while the pressure was increasing, and more complete distribution through the body. The increasing atmospheric carbon dioxide was believed to be a factor in the severity of the lesions.

Roentgenograms in the three cases showed small rounded areas of rarefaction surroanded by a thin shell of hypercalcification in the ends of the long bones, confirming the pathology of infarction followed by aseptic necrosis and incomplete repair. In the severe case the heads of both femora had partially collapsed, resulting in well marked osteoarthritis deformans.

Rickets in Iceland. Níels Dungal. Am. J. M. Sc. **210:** 70–76, July 1945.

Because rickets in Iceland rarely occurs in its most extreme forms, the work of Thoroddsen, who found the disease in 51.5 per cent of children up to two years of age, has been doubted.

The author examined 239 Icelandic children from three months to two years old. Clinically special attention was paid to the fontanelles, parietal prominences, occipital flattening and hairlessness, rachitic rosary, Harrison's groove, and deformities of the extremities. No single sign was considered sufficient for a diagnosis. A distinct rachitic rosary practically never occurred alone. Few signs were found in the extremities.

Roentgenograms of a knee, wrist, and particularly of an ankle were taken of each child. The principal diagnostic criterion was the appearance of the line of calcification at the epiphysis. Instead of being straight, clear-cut, and narrow, as in normally growing bone, the line is indistinct, indented, and broken. In severe cases only a broad band of uncalcified tissue is seen; eventually the distal end becomes broad and concave. The trabeculae of the spongiosa become blurred and the diaphysis loses its strength and straightness. The medial articular margin of the tibia appears to be broader and flattened so that the condyle becomes pointed. Sometimes the lateral condyle also assumes this appearance. While the roentgenographic findings in the author's series generally conformed to the clinical findings, occasionally unmistakable clinical signs were present when no definite radiologic signs could be found.

The author found 77 per cent of all children to have rickets. His survey showed that every child would develop rickets unless some kind of prophylaxis was received. It appeared that the usual cod-liver oil dosage was insufficient, and that only those children had normal bones who had had artificial sun baths for a long period of time. Because of the long dark winter months, specific antirachitic therapy is required. The long summer days do not afford adequate protection.

BENJAMIN COPLEMAN, M.D.

Infantile Dwarfism (Encephalomyelitis) in Siblings. John Monfort, Silik H. Polayes, and Reuben Sorkin. Am. J. Dis. Child. **70:** 4–8, July 1945.

Detailed case histories are presented of two sisters who apparently ceased to grow mentally or physically after the age of three months. The facts that these children were the offspring of parents (Italian) who were first cousins and that the mother had 8 miscarriages in 15 pregnancies suggest a possible inherited familial background or constitutional factor contributing to the etiology. Both pregnancies were uneventful, no forceps were used in the deliveries, which were normal, and no immediate postnatal complications developed.

The older child weighed 7 1/2 pounds at birth in 1935 and only 8 pounds 2 ounces at the time of writing, when she had reached the age of seven and a half years. Muscular spasms began at the age of three months, and the child gradually assumed an attitude of spastic flexion of all joints. Laboratory examinations at five years of age, including blood chemistry, blood cell and differential counts, urinalysis, and Wassermann tests, were essentially negative. An electro-encephalogram showed practically no cerebral activity.

Roentgen examination of the skeleton showed varying stages of development from two months to eight years. All bones had a ground-glass appearance, with definite thinning of the cortex and a corresponding wide medullary space. The calvarium showed all fontanels entirely closed and bone thickness of a two-year-old child. The semicircular canals, usually not visualized after two months of age, were very distinct. There was prognathism of the maxilla and recession of the mandible, but the diminution of the width and depth of the posterior and middle fossae characteristic of microcephalus was not present. The pituitary fossa was very small. The frontal sinuses were present. Encephalograms revealed cystic dilatations in the midbrain. Development of the epiphysis of the head of the humerus approximated that of an eight-year-old but the carpals showed only three ossification centers, typical of a two-year-old. The lower extremities averaged a bone age of five years.

The younger sister exhibited similar findings on hospital admission, at the age of two years. She died unexpectedly about eight months later. Autopsy revealed an external hydrocephalus with pressure atrophy of the pituitary gland and cerebral degeneration and atrophy, especially of the cortical ganglion cells. The pars intermedia was cystic. The thymus had almost completely retrogressed and was represented by a small quantity of connective and lymphoid structure with complete calcification of a few corpuscles. The thyroid was small, showing a number of areas of fetal parenchyma, although the remainder of the gland was of normal structure. The adrenal glands showed medullary hypoplasia. LESTER M. J. FREEDMAN, M.D.

Case of Cleidocranial Dysostosis. Helge Eltorm. Acta radiol. **26:** 69–75, Jan. 22, 1945. (In English.)

The author reports a case of cleidocranial dysostosis in a woman 52 years old. There were also failure of development of the permanent teeth, maldevelopment of the wrists and elbows, brachyphalangia, bilateral coxa vara, and maldevelopment of the thoracic vertebral bodies. The patient's mother also had cleidocranial dysostosis, but no other member of the family.

LEWIS G. JACOBS, M.D.

Hereditary Multiple Exostosis. Review of the Literature and Report of a Case with Horner-Bernard Syndrome as a Complication. Lloyd D. Fisher, Clare Parsons, and Cecil C. Cutting. Permanente Found. M. Bull. **3:** 124–136, July 1945.

A case of hereditary multiple exostosis, with one lesion arising from the third rib and producing a Horner's syndrome, is presented. Approximately half of the members of the patient's family were affected with exostotic lesions. Roentgenograms are reproduced.

The confusion of nomenclature in hereditary multiple exostosis is discussed. The literature is reviewed, and the clinical picture, pathology, pathogenesis, eugenic implications, and etiology are considered.

Case of Cystic Tuberculosis in Bone and Joint. Ingolfur Blöndal. Acta radiol. **25:** 366–371, Sept. 20, 1944. (In English.)

The author describes a case of tuberculosis of the left hip joint combined with a cystic process in the upper part of the femur. Repeated examinations showed spread to the adjoining portions of the femur, the acetabulum, and the pelvis. The course of the disease was slowly progressive, but a definite healing tendency was obvious after about eight years' duration. At this time, however, the patient, who had been observed from the age of three years to the age of eleven, died of miliary tuberculosis.

The diagnosis of tuberculosis of the hip joint in this case is based on the clinical picture, the strong tuberculin reaction, and the death from miliary tuberculosis. There was no confirmation by histologic examination or by demonstration of tubercle bacilli.

ERNST A. SCHMIDT, M.D.

Osteochondritis Dissecans of the Supratrochlear Septum. W. S. Millman. Canad. M. A. J. **53:** 55–57, July 1945.

Osteochondritis dissecans consists in a necrotic process which separates a bone fragment beneath an articular cartilage. This fragment may later become a loose body in the affected joint. Trauma is considered the most probable etiologic agent. The disease is one of young adults, usually males, and most commonly involves the medial femoral condyle, but has been described elsewhere.

The author presents the findings in a man of 29 years who complained of pain in the elbow and inability to completely extend the joint. There was a history of injury fifteen years previously but there had been no intervening disability and no recent trauma. Radiographic study revealed a small loose fragment in the elbow joint space on the medial side and a punched-out defect in the supratrochlear septum with a fuzzy outline. The opposite elbow was normal. The fragment was removed surgically and on pathologic study diagnosed "osteochondroma." The patient was relieved of his symptoms.

BERNARD S. KALAVJIAN, M.D.

Osteochondritis Dissecans of the Head of the Femur. Ivan Hermodsson. Acta radiol. **25:** 269–304, Sept. 20, 1944. (In German.)

The cases of osteochondritis dissecans of the femoral head may be divided into two groups: primary and secondary. The first stage of primary osteochondritis dissecans is represented by aseptic necrosis, forming a focus of lessened resistance. Under the influence of strain or injury, a pathologic fracture develops in the most exposed part of the head, *i.e.* in the upper pole. This fracture engenders aseptic necrosis, which results in osteochondritis dissecans. This theory, originally formulated by Axhausen, is supported by the fact that, as a rule, the disease affects hard-working laborers. Secondary osteochondritis dissecans is observed in cretinism and in fractures of the femoral neck. Multiple hereditary anomalies of the epiphyses (Ribbing type) and multiple osteochondritis dissecans probably belong to the secondary category.

The author describes several cases of an intermediate form between Perthes' disease and osteochondritis dissecans. For these latter forms the term "osteochondritis deformans dissecans" or "osteochondrosis deformans dissecans" is suggested.

ERNST A. SCHMIDT, M.D.

On the Incidence of Osteochondrosis. Sv. A. Chrom. Acta radiol. **26:** 49–55, Jan. 22, 1945. (In English.)

Osteochondrosis is defined as the syndrome characterized by low back pain accompanied by a narrowed intervertebral disk (usually fifth lumbar) with hypertrophic changes and sclerosis of the borders of the adjacent vertebral bodies. There may also be a relative displacement of the bodies, simulating a spondylolisthesis. The material evaluated consists of one year's patients, 50 women and 82 men, and of these 20 had the characteristic picture. As controls, 63 patients without back pain were studied (they had been referred for barium enema), comprising 37 women and 26 men. Of these, 2 showed typical changes, but on further questioning 1 of the 2 was found to have characteristic symptoms and appears to have been included among the controls by accident. The other represents an incidental asymptomatic osteochondrosis. Spondylosis deformans and prolapse of the nucleus pulposus are to be differentiated, the latter by myelography.

LEWIS G. JACOBS, M.D.

Rheumatoid Spondylitis, with Special Reference to Early Diagnostic Criteria. Arthur J. Present. Calif. & West. Med. **63:** 10–13, July 1945.

In an eighteen-month period, 75 young men with rheumatoid spondylitis were admitted to an Army General Hospital. In such cases an early diagnosis and prompt institution of treatment are essential for alleviation of symptoms. The roentgen diagnosis is based primarily on the identification of typical rheumatoid arthritic changes in the sacroiliac and apophyseal joints. Contrary to the experience of Oppenheimer (Am. J. Roentgenol. **49:** 49, 1943. Abst. in Radiology **41:** 306, 1943), the author found no instance of apophyseal involvement without definite sacroiliac manifestations. The simple anteroposterior view of the lumbosacral spine was found to be most satisfactory for demonstrating the pathological changes. For the apophyseal joints 45-degree-angle films gave the best visualization.

On the basis of the roentgen findings a series of 50 patients is divided into three groups. The first group consisted of 24 patients with minimal sacroiliac joint changes, with or without apophyseal joint involvement. In most instances the changes were bilateral.

The joints showed a hazy, blurred, or ground-glass appearance. The sharp penciled double lines about the inferior cartilaginous portion of the joint had become broken or disappeared, so that the margin was broadened and irregular. There was no rarefaction of the vertebral bodies and no ligamentous calcification in these early cases. Loss of the normal lumbar curve was a striking feature in some instances. Nineteen moderately advanced cases constituted the second group. These patients showed more pronounced sacroiliac manifestations, usually associated with apophyseal changes, especially in the lumbar area. Rarefaction of the adjacent ilium was frequent, as were mottling and a loss of trabecular definition. Fragmentation, scalloping, and obliteration of the joint margins was observed. In the apophyseal joints erosion, with roughening or scalloping of the facets, was visible, and the joint spaces were narrowed. Calcification of the spinal ligaments was observed in 9 cases of this group. In the third group, consisting of 7 advanced cases, the picture ranged from ankylosis of the sacroiliacs and one or more apophyseal joints, with or without ligamentous calcification, to extensive ankylosis of all the diarthrodial joints of the entire spine, including the costovertebral articulations.

The author adds that radiotherapy is apparently effective in arresting the progress of the disease.

MAURICE D. SACHS, M.D.

On Bechterew's Disease from the Roentgenologic Point of View. Kristian Overgaard. Acta radiol. **26:** 185–209, Jan. 22, 1945. (In English.)

After discussing the symptoms and pathology of ankylopoietic spondylarthritis, or Bechterew's disease, the author describes the roentgen changes. The sacroiliacs are often involved in the early stages, the characteristic picture being a scattered, slightly cloudy group of opacities about the joint, with subchondral spotty decalcification and vague, blurred demarcation. Confluence of small rarefactions may give the appearance of widening of the joint; this is more common in the lower portion. Osteophytes may be formed across the joint. As the disease progresses, the new bone formation predominates and the joint pattern is effaced by new-formed, slightly compact osseous tissue, through which remnants of the articular outlines can often be distinguished. In far-advanced cases, every vestige of the joint may be effaced. These characteristic changes were present in all (31) of the author's cases. Changes in the vertebrae are less important from the standpoint of diagnosis because, though they are distinctive, they are of relatively late appearance. Sometimes slight halisteresis of the vertebral bodies (seen only on the lateral view) is an early change. Flattening of the lumbar lordosis and a highly placed arcuate thoracic kyphosis without change in the individual vertebrae are characteristic. Changes in the intervertebral articulations are shown in the oblique view in most cases. Later calcifications occur in the ligaments. These findings make diagnosis easy.

Fourteen of the author's patients were given roentgen therapy (180 kv., 1 mm. copper and 1 mm. aluminum filter, 10 × 15-cm. fields, maximum 4 fields, 150 to 200 r × 2 per treatment). The immediate symptomatic improvement was good and was sustained in 9 of the 10 patients followed (from one to four years).

LEWIS G. JACOBS, M.D.

Duvernay's "Forage" of the Femoral Epiphysis: Follow-Up Examination of 41 Cases. Jørgen Ernst. Acta radiol. **26:** 76–88, Jan. 22, 1945. (In French.)

The operation discussed here consists of boring one or more holes in the head and neck of the femur, which may or may not then be filled with dead bone. The pain of arthroses of the hip is relieved and the condition improved by the procedure. The mode of action is not clear. The operation is most effective in cases characterized by osteoporosis and cyst-like degenerations in the bone; in the type characterized by sclerosis and osteophyte formation with cystic degeneration it is less effective.

Forty-one such operations were done in 39 patients in the fourth to the eighth decades, with symptoms for less than one to over thirty years. In 8 the changes were secondary to trauma. Immediately after the operation, 90 per cent of the hips were painless or improved; after six months, 76 per cent; after 2 years, 70 per cent; after six years, 64 per cent. Improvement of motion was noted in a third of those whose pain was alleviated, but in only 10 per cent of those clinically unimproved. In many of the cases with clinical betterment, improvement was also demonstrable roentgenographically.

LEWIS G. JACOBS, M.D.

Para-Articular Calcification (Pellegrini-Stieda) in Affections of the Knee. I. William Nachlas and John L. Olpp. Surg., Gynec. & Obst. **81:** 206–212, August 1945.

Observations on 20 men with calcific deposits medial to the lower end of the femur were supplemented by a study of one operative and one autopsy specimen and dissections of the area in 9 cadavers.

The calcified masses are shown roentgenographically to be in the soft tissues on the medial aspect of the knee, directly overlying the adductor tubercle. They may be a centimeter or more in length and are plaque-like in form, conforming generally to the contour of the underlying bone, being straight, curved, or S-shaped, depending on their length. They sometimes appear to be attached to the bone, but in such cases further examination with a change of position will show them to be separate.

Studies of the operative and autopsy specimens showed a white fibrous membrane covering the tibial collateral ligament, adductor tubercle, and tendon of the adductor magnus, traversed longitudinally by three small parallel veins. This glided easily over the adductor tubercle on flexion of the knee. Adherent to the under surface was a bony, button-like plaque, molded to the contour of and in contact with the periosteum of the adductor tubercle, but separated from it and without connection with the joint. This is considered the typical position of the Pellegrini calcification.

In the authors' series trauma appeared to be a frequent but not indispensable etiologic factor. Since chronic inflammatory changes were coexistent in all the cases, they too are considered to play a causative role. The trauma may take the form of a single severe tear or may be the cumulative effect of a process of attrition originating in a series of minor injuries which attract little or no attention. This process is speeded by the swelling of the tissues induced by a systemic or long-standing traumatic arthritis. As a result of the degenerative process affecting the under surface of the membrane, the tensile strength is reduced so that a rela-

tively moderate injury may cause an incomplete tear. This rupture is associated with a laceration of small blood vessels producing moderate bleeding. The small hemorrhage is trapped locally and is molded in its position by the outer coating of the membrane. The encapsulated hematoma thus formed undergoes degenerative changes which, under the proper physical and chemical conditions, lead to calcification. The authors believe that many cases can be recognized clinically, if careful palpation of the region of the adductor tubercle is added to the usual clinical procedures.

As mentioned above, there was in all the patients of the present series an associated arthritis of the knee joint, as shown by bony lipping, a thickened capsule, and sometimes by joint fluid. This arthritic process rather than the calcification is considered by the authors to be the major disabling factor, the calcification itself being of little significance in the production of symptoms.

Treatment of the arthritis is not considered here. For the calcification, conservative measures are usually sufficient. ARTHUR W. PRYDE, M.D.

Air Arthrography in Diagnosis of Torn Semilunar Cartilage. E. G. Herzog. Lancet **2:** 5–6, July 7, 1945.

In 12 cases of injury to the knee joint, a diagnosis could not be made by simple clinical means and air arthrography was carried out. A torn semilunar cartilage was diagnosed in 8 of these cases and excluded in 4. Operation or the subsequent history confirmed the findings in 10 instances.

The author's technic is as follows: The leg is prepared as for operation and the procedure is carried out under full aseptic conditions. A No. 20 needle is inserted into the suprapatellar pouch after injection of a little novocain. Any effusion is aspirated. Air, filtered through several layers of gauze, is injected with a 20 c.c. syringe fitted with a three-way tap. In the series reported the amount of air used varied between 60 and 120 c.c., depending upon the distention produced and the amount of pressure needed to push home the piston. A collodion dressing is applied and a bandage is used to compress the suprapatellar pouch and increase the amount of air in the joint. With the patient on his side, the line of the knee joint is marked under the fluoroscope. This is important because the beam must pass exactly along the joint line if overlapping in the film is to be avoided, and since this line by no means always runs at an exact right angle to the long axis of the limb, it cannot otherwise be estimated. With the tube horizontal and the central beam passing through the knee tangentially, three views are taken of the cartilage. The joint should be opened by abduction (adduction when the external cartilage is suspected) of the leg over a sandbag. If other joint lesions are suspected, the usual three views of the whole knee joint can be taken. A film showing the retropatellar space will disclose chondromalacia patellae if it is present.

No case of sepsis followed this procedure, and none of the patients complained of pain.

"Metastatic" Calcification in Soft Tissues of Legs in Osteitis Deformans: Case Report. Bernard Seligman and Louis Nathanson. Ann. Int. Med. **23:** 82–91, July 1945.

"Metastatic" calcification in the soft tissues has been reported in only one previous case of osteitis deformans (Wells and Holley: Arch. Path. **34:** 435, 1942). Metastatic calcification is to be distinguished from calcinosis. The former represents calcification of apparently healthy tissue due to changes in the composition of the blood calcium and phosphorus salts, phosphatase, or alkalinity. The latter represents another stage of an underlying pathologic process such as occurs in scleroderma, sclerodactyly, Raynaud's disease, etc.

The authors' patient had advanced Paget's disease of all the skeletal structures, demonstrable roentgenographically. The disease appeared to be most marked in the skull, pelvis, spine, and lower extremities. The skull, in particular, was tremendously enlarged, having a scaphocephalic configuration with considerable flattening. The maxillary, ethmoidal, and sphenoidal sinuses were obliterated by overgrowth of bone. The bones of the base of the skull were dense and eburnated, with similar alterations in the temporal bones. In addition to the advanced distortion of the pelvis due to Paget's disease, a flattening and deformity of the hips producing a coxa vara configuration were apparent.

The lower extremities, in addition to evidence of Paget's disease, showed extensive calcification of a granular and mottled type within the soft tissues. This was most pronounced in the subcutaneous tissue and extended through the muscle planes particularly along the mesial and posterior surfaces from below the level of the knee to above the ankle joint. The patient had had edema and venous stasis of the legs, due to heart failure, for eight years. There was no soft-tissue calcification in the upper extremities.

Moderately advanced calcification was present in the abdominal and pelvic vessels, but no calcification in the popliteal or tibial vessels at the level where the soft-tissue calcification was found. Several fractures of both lower extremities were seen, which healed normally. The soft-tissue calcification was apparently not related to the fractures. Minimal calcification was present in the thoracic aorta and mottled changes could be demonstrated through both lungs, many of which had a circumscribed appearance suggesting calcification within pulmonary vessels.

It is difficult to explain with the information at hand why calcification of the soft tissues of the body occurred in this case. In osteitis deformans a negative calcium and phosphorus balance is present in the earlier and more active form of the disease. A positive balance occurs in the later and less active stages, with blood calcium and phosphorus levels normal throughout. The serum phosphatase, however, is increased during the entire disease, sometimes to extremely high levels.

The authors stress the absence of chronic renal insufficiency which can be associated with the protracted presence of calcium and phosphorus ions in the blood in concentrations far in excess of those at which deposition of calcium phosphate may be expected theoretically. They believe that the edema of the lower extremities played an important etiologic role. The patient had received viosterol and calcium over a period of one and a half years, but no significance is attributed to this.

STEPHEN N. TAGER, M.D.

Tissue Calcification and Renal Failure Produced by Massive Dose Vitamin D Therapy of Arthritis. T. S. Danowski, A. W. Winkler, and J. P. Peters. Ann. Int. Med. **23:** 22–29, July 1945.

Two cases of renal damage secondary to prolonged therapy with vitamin D are described in detail. In one

of these extensive calcification of soft tissues was readily demonstrable.

The first patient was a woman originally seen in 1932 for a painful deforming arthritis of the extremities, of eighteen years' duration. Laboratory studies at that time were within normal limits. Roentgen examination of the right wrist and hand and of the hips showed narrowing of the joint spaces with thinning of the adjacent bone but no generalized osteoporosis. From 1936 to May 1942 the patient received 150,000 to 200,000 units of vitamin D daily. In November 1942 she returned to the hospital with localized fluctuant swellings at the left wrist and right ankle. Laboratory studies now showed anemia and renal insufficiency. The findings included azotemia, urine of low specific gravity, albumin 2 plus, casts, decreased excretion of phenolsulfonphthalein, and a high serum calcium and phosphorus. Roentgenograms showed decalcification of all bones except the skull, narrowing or destruction of joint spaces, and extensive calcific deposits in the soft tissues of the hands, wrists, and right ankle. No calcification was demonstrable in the abdominal organs.

Two and a half years after cessation of vitamin D therapy, serum calcium and phosphorus values had returned to normal; the non-protein nitrogen of the blood was still high, but the urine was free of albumin and casts. Roentgenograms revealed a striking decrease or complete disappearance of calcium in the soft tissues of the hands, wrists, and ankle. In addition, complete destruction and absorption of some of the bones of the wrists were evident, together with concentric decrease in the head of the right femur and movement of the right acetabular surface upward.

The second patient was admitted for intermittent abdominal cramps, nausea, and vomiting, of three months' duration. On her physician's advice, she had been taking vitamin D for seven months for relief of arthritic pain. The initial daily dose of 50,000 units was increased in the course of eight weeks to 500,000 units, at which level it was maintained for five months, being discontinued two months before admission. Laboratory studies revealed hypochromic anemia, an elevated blood non-protein nitrogen content, urine of low specific gravity, and poor excretion of phenolsulphonphthalein dye. A distinct hypercalcemia existed, together with an increased concentration of serum phosphorus. The skull was osteoporotic; proliferations of bone were seen at the knee and hip joints, and on the vertebral bodies, of the type associated with hypertrophic osteoarthritis. There was no metastatic calcification. Repeated serum calcium and phosphorus determinations showed a gradual return to normal values during the next twelve weeks.

These two cases indicate that vitamin D in large doses provokes a hypercalcemia and increases the calcium content of the soft tissues, particularly of the kidney. The hypercalcemia favors metastatic calcification. This may be facilitated by local tissue injury already present, or produced by the vitamin D itself. Calcification in the kidney affords a satisfactory explanation of the renal damage even though, in the cases here recorded, the calcium deposits were too low in concentration to be demonstrated in roentgenograms. This impairment of renal function by vitamin D is to a considerable extent reversible.

The extensive destruction of bone evident in the wrists and right hip of the first patient is an anomalous development in the natural course of atrophic arthritis. It suggests that the extensive intake of vitamin D together with a low intake of calcium and phosphorus produced disruption of the histology of the bone, of the type reported in rats, with subsequent absorption of the injured bone. During the first five of the six years of therapy this patient did not drink milk nor did she receive supplementary calcium.

No clear principle has been formulated for a rational use of vitamin D in arthritis. Clinical improvement reported during its administration is not correlated with any consistent alteration in the density of the skeleton or of exostoses. In serial roentgenograms the osteoporosis may increase, decrease, or remain unchanged. There is no evidence that improvement is related to the development of hypercalcemia. It seems clear, therefore, that the favorable effects reported are unrelated to the metabolism of calcium and phosphorus, which is not surprising in view of the repeated failure to demonstrate any definite abnormality in the calcium and phosphorus balance of patients with arthritis. That treatment with vitamin D demands careful supervision is obvious.

STEPHEN N. TAGER, M.D.

Fatigue Fracture of the Tibia. Three Cases at a Naval Training Establishment. Trevor P. Mann. Lancet **2:** 8–10, July 7, 1945.

Three cases of fatigue fracture of the tibia in adolescent naval recruits were encountered in six weeks at a training establishment. The clinical and radiological findings suggest that the condition is a well defined entity. The author believes that the paucity of published cases in Great Britain during the war indicates that the condition is being overlooked in the Services.

Fatigue Fracture of Femur and Tibia. H. R. I. Wolfe and J. M. Robertson. Lancet **2:** 11–13, July 7, 1945.

Two cases of fatigue fracture, one of the tibia and the other of the femur, are reported. These illustrate the occurrence of such lesions in healthy young adults undergoing intensive training and the need for thorough treatment.

Stress Fracture of Femoral Neck. John A. W. Bingham. Lancet **2:** 13–14, July 7, 1945.

A case of stress fracture of the femoral neck is presented. This case differs from others so far reported in that there was a basal fracture of the neck of the femur with varus deformity, such as occurs typically in fractures due to gross violence. From cross-questioning of the patient it was learned that he had suffered no gross injury. Slight pain had come on immediately after a training exercise, becoming much worse a few days later. From the history it seems probable that the fracture had at first been a crack without displacement and that subsequently the fragments separated and became displaced, with increasing pain.

THE GENITO-URINARY SYSTEM

Renal Hypoplasia with Hydroureter and Primary Amenorrhea. Report of a Case. Frank M. Huff and William P. Boger, Jr. J. Urol. **54:** 116–122, August 1945.

The authors call attention to the frequent association of genital and upper urinary tract anomalies, particu-

larly absence of one kidney in the presence of genital anomaly in the female. They differentiate between renal agenesis, aplasia, and hypoplasia, the important point being the complete absence of renal tissue in agenesis.

The case presented is that of a 26-year-old woman who complained of complete absence of menstruation, urinary frequency, and left upper abdominal distress radiating toward the bladder. Examination revealed a mass in the right upper quadrant, shown roentgenologically to be due to hyperplasia of the right kidney, and an indefinite mass in the left upper quadrant. Roentgenograms showed an absence of the left kidney shadow and there was no appearance of dye on the left in the excretory urogram.

Cystoscopy revealed a minute left ureteral orifice with a very small excretion of phthalein dye from that side. After dilatation of the ureteral meatus and passage of a No. 8F catheter, 75 c.c. of clear urine was obtained. Retrograde urography showed a greatly dilated and tortuous left ureter, but no renal pelvis could be demonstrated.

Investigation of the uterus by both hysterography and curettement showed a very small uterine body with a rudimentary uterine cavity.

At operation a very small left kidney without calices was found. The ureter was extensively dilated and showed a stricture of the intramural portion. The left urinary tract was removed down to the bladder. Microscopically the kidney parenchyma was normal.

J. L. BOYER, M.D.

Primary Carcinoma of Ureter with Special Reference to Hydronephrosis. Review of Literature and Report of an Unusual Case. Joseph A. Lazarus and Morris S. Marks. J. Urol. **54:** 140–157, August 1945.

The authors' patient was a woman of 41, referred to them because of an epigastric mass. Her chief complaints were precordial pain and palpitation and episodes of urinary frequency. About twelve years previously she had experienced an attack of pain in the urinary bladder, which recurred two years later and was diagnosed, after an incomplete urologic examination, as cystitis. After a ten-year period without symptoms dysuria again occurred, followed by what appeared to be an attack of coronary heart disease. It was during the course of cardiographic studies that the mass in the epigastrium was discovered. It was firm and non-tender and did not move with respiration.

Roentgenography showed outward dislocation of the lower pole of the left kidney and, medial to its inner border, a pear-shaped shadow parallel to the psoas margin. In the lateral view there was an indistinct shadow of a mass anterior and parallel to the lumbar spine. Excretory urography showed a normal right kidney but enormous enlargement of the left renal silhouette.

Operation disclosed a tumor of the left ureter, which proved histologically to be a transitional-cell carcinoma, with metastases in the renal peripelvic region. The ureter above and below the tumor was dilated and the kidney was converted to an enormous multilocular hydronephrotic sac which had been pressing on the heart through the diaphragm and possibly irritating the vagus nerve and solar plexus, producing the cardiac symptoms of which the patient complained.

There follows an excellent discussion of primary tumors of the ureter, especially those which take origin from the ureteral mucosa. The authors consider their classification, incidence, and symptoms. They state that, while pain, hematuria, and an enlargement of the kidney are supposed to constitute a characteristic triad of symptoms in these cases, the diagnosis cannot be made on this basis but requires carefully executed and correctly interpreted roentgen and cystoscopic studies. In their opinion, a clear-cut and persistent filling defect in the ureterogram, especially when associated with ectasia of the segment of ureter just above, constitutes the only pathognomonic sign of ureteral tumor. The chances of demonstrating such a defect would be enhanced if repeated attempts were made to obtain good ureterograms in all cases with evidence of ureteral obstruction, bleeding through the ureteral catheter as a result of manipulation at the site of obstruction, and failure to show a calculus at the point of obstruction. The treatment of choice is complete extraperitoneal nephroureterectomy. N. P. SALNER, M.D.

Vaso-Seminal Vesiculography and Its Clinical Application. Arne Bertelsen and H. H. Wandall. Acta radiol. **26:** 36–45, Jan. 22, 1945.

Roentgen examination of the male genitals as performed by the authors was conducted by exposing the vas immediately proximal to the testis through a small scrotal incision and injecting 3 to 5 c.c. of perabrodil into the lumen through a small hypodermic needle. The contrast material may be injected by the transurethral approach into the ejaculatory duct.

Sixteen examinations are reported, 6 in the course of sterilization procedures on account of imbecility and 10 in patients with disease of the genital system. The seminal vesicles were found to be quite variable, from a simple canal to a dilated structure containing diverticulum-like expansions. The junction of the vas and ejaculatory duct was always distinct. In 4 persons the canals united to form a single ejaculatory duct, and in 2 there were separate ducts on each side, opening side by side into the urethra. Obstruction was readily diagnosed, but inflammatory changes were hard to diagnose because they cause so slight an alteration and the normal is so variable. The procedure is safe and is indicated in patients with aspermia and with seminal vesiculitis, in adults about to undergo orchidopexy, and in patients with pain in the groin following herniotomy.

LEWIS G. JACOBS, M.D.

Some Practical Hints on the Performance of Urography on Infants. Harald Christiansen. Acta radiol. **26:** 46–48, Jan. 22, 1945. (In English.)

In infants, the more or less elaborate preparations for urography employed in adults are impractical. Copious defecation and fasting for three or four hours before examination are sufficient. Although intravenous administration of the medium is best, the cubital veins are seldom accessible, and it is too dangerous to use the fontanelle, as an accidental subdural injection may be fatal. The superior temporal vein and its branches are the best to use, the contrast substance being introduced with a fine needle. If the intravenous route is impractical, intraosseous injection is recommended, a sternal cannula being inserted into the anteromedial face of the tibia. Gas in the bowel is displaced by distending the stomach with 50 c.c. of apollinaris sweetened with saccharine; the kidneys are then seen through the stomach shadow. A roentgenogram illustrating this effect is reproduced. LEWIS G. JACOBS, M.D.

TECHNIC

Protection in Roentgenoscopy. John F. Bacon and Eugene T. Leddy. M. Clin. North America **29:** 1036–1041, July 1945.

In a study of 135 physicians who came to the Mayo Clinic between 1919 and 1935 for advice about or treatment of roentgen-ray injury, it was found that 91 had contracted their injuries during reduction of fractures with the fluoroscope. Of this number, 78 admitted the use of no protection and 11 began to use lead rubber gloves only after injury became apparent. Of the 135, only 8 had had any roentgenologic training, and these 8 had all failed to follow the recommended measures of protection until they had been injured.

The inexperienced or careless operator may exceed the limits of safety to himself by (1) lack of proper technic of examination; (2) excessive "puttering around"; (3) incomplete adaptation of the eyes to darkness; (4) too much current and voltage; (5) insufficient filtration in the roentgenologic apparatus; (6) use of too large fields; (7) placing the bare hand in the field; (8) lack of lead rubber protecting gloves; (9) inattention to the time that the roentgen tube has been in operation; and (10) ignorance of the protecting devices advocated by the Safety Committee.

The observation of the following rather simple rules will reduce the number of injuries markedly: (1) Know the output of the machine and the time it takes the machine in operation to reach an output which represents the limit of safety to the skin. Calibration of the tube in r per minute is essential. (2) Use an aluminum filter at least 1 mm. thick. (3) Determine the lowest intensity of rays which allows satisfactory visualization. (4) Be certain of thorough "dark adaptation" of the eyes. (5) Wear lead rubber gloves and carry out manipulations with the hands outside the beam as much as possible. (6) Use roentgenograms instead of the roentgenoscope.

Training, common sense, and experience are probably the three most important protective devices with which the operator can fortify himself. Carelessness and ignorance are the most common causes of injury from irradiation.

Roentgen Cinematography as a Routine Method. Bengt S. Holmgren. Acta radiol. **26:** 286–292, March 31, 1945. (In English.)

The advantages and disadvantages of modern roentgen cinematography, as described by Holm (Acta radiol. **25:** 163, 1944. Abst. in Radiology **46:** 531, 1946) are discussed. Emphasis is laid on the value of the method for the study of deglutition and examination of the esophagus. The advantages of cinematography in arteriography and venography are also set forth.

The author considers the cinematographic method of particular value for teaching, as it eliminates crowding about the fluoroscopic screen, does away with unnecessary examinations, and makes available a wider range of material than is likely to be represented in the hospital at any one time. F. ELLINGER, M.D.

Results of Micro-Radiography. F. Bohatyrtschuk. Acta radiol. **25:** 351–365, Sept. 20, 1944. (In German.)

In spite of the fact that microradiography has been employed for over thirty years, the method is still little known and has failed to obtain general acceptance. The necessity, or at least advisability, of special x-ray tubes, extremely delicate photographic emulsions, and other technical difficulties have resulted in only rare investigations and references in the medical literature. Microscopic sections, 20 to 50 micra thick, are used, usually with a contrast medium. While x-ray exposures of 5 kv. and 100 ma. may be employed, more frequently exposures of 10 to 15 ma. and 6 to 10 minutes are the rule. The most common microscopic magnifications vary from 10 to 60 times. However, by means of fine granulation emulsions, radiography of magnifications up to 600 or even 800 times is possible, necessitating exposures of 30 to 40 minutes (at 15 ma.). Bohatyrtschuk's work is especially concerned with the visualization and study of the capillaries. The technical factors of the method are described in detail, including the preparation of the emulsion. A number of microroentgenograms are produced.

ERNST A. SCHMIDT, M.D.

RADIOTHERAPY

Treatment of Hemangiomas with Roentgen Rays. James V. Prouty. Am. J. Roentgenol. **54:** 172–177, August 1945.

The use of unfiltered roentgen rays in the treatment of hemangiomas is described. For all flat lesions and for thick lesions with a diameter greater than 3.0 cm., rays produced at 80 kv. are used, with a target-skin distance of 15 cm. For all lesions thicker than 0.5 cm. and with a diameter less than 3.0 cm., 135-kv. radiation is employed at 18.0 cm. distance. The lesion is shielded with lead foil, and from 300 to 600 r are given at one treatment, depending upon size and location. The larger doses are used in lesions of a centimeter or less in diameter. An occasional mild erythema occurs along the edge of the lesion with these larger doses, but otherwise no reactions have occurred. Treatment is repeated in one month if there is no response and no erythema. If the lesion shows response to the first treatment, two months are allowed to elapse before continuing treatment. Great care should be taken in the treatment of lesions near epiphyses and glandular structures. In 129 cases treated from December 1939 to January 1944, the results were classified as follows: excellent, 87; good, 27; fair, 8; poor, 4. L. W. PAUL, M.D.

Slowly Developing Non-Pigmented Nevo-Epithelioma Presenting a Non-Characteristic Histologic Picture. Jens Munck Nordentoft. Acta radiol. **26:** 155–162, Jan. 22, 1945. (In French.)

Report of a case of non-pigmented nevo-epithelioma with multiple metastases. Some palliation was obtained from roentgen therapy and the patient survived five years, an unusually long course.

Roentgen Treatment of Malignant Tumors of the Nasopharynx. Jens Nielsen. Acta radiol. **26:** 133–154, Jan. 22, 1945. (In English.)

The author discusses the clinical and pathological aspects of nasopharyngeal tumors and describes 37

cases treated by the Coutard method (180-200 kv., 4–6 ma., Thoraeus filter, 50–70 cm. F.S.D., 2 1/2–7 1/2 r/min., and usually 2 daily treatments). The dose per treatment was 75 to 200 r; total dose, 3,300 to 10,000 r. Five years later 9 of the group were apparently cured, 2 were alive with recurrence, and 26 dead. Patients with sarcoma did somewhat better; no patient with a highly differentiated carcinoma was cured. Even in cases with invasion of the base of the skull, considerable palliation was obtained. LEWIS G. JACOBS, M.D.

Skeletal Metastases in Cancer of the Breast: Study of the Character, Incidence and Response to Roentgen Therapy. Jean Bouchard. Am. J. Roentgenol. **54:** 156–171, August 1945.

A study of skeletal metastases from cancer of the breast is presented, based on 37 cases seen since 1938 with 24 of the patients having died up to the present time; 87.5 per cent of the cases belonged to clinical Groups II and III and bone metastases seldom occurred unless there had been invasion of the axillary lymph nodes. Skeletal lesions were the only metastases demonstrable in 62.5 per cent of the group. The age factor did not seem of any significance in determining the incidence or degree of malignancy of the metastases. Three general types of roentgenographic change are described: (1) the osteolytic type, observed in 75 per cent of the cases; (2) the osteoblastic type, in 8.3 per cent; (3) the osteolytic-osteoblastic type, in 16.7 per cent. All three types may be seen in the same patient at some time during the course of the disease.

Under roentgen therapy, 66 per cent of the series showed subjective improvement, with 26 per cent also showing an objective response to irradiation. The average survival for this latter group was 18 months while it was 13.6 months for the group as a whole.

L. W. PAUL, M.D.

Carcinoma of the Uterine Cervix: Interval Report on Treatment, Results, and Complications. George Van S. Smith and R. Dresser. Am. J. Obst. & Gynec. **50:** 1–10, July 1945.

This report covers a series of 1,111 cases of cervical cancer treated between 1902 and 1938, inclusive. The authors have divided their cases into groups, because of changes in type of treatment from time to time.

In the first group are 83 cases seen between 1902 and 1913. Of these, 8 were untreated; 37 were treated by cauterization; 6 by amputation of the cervix; 32 by hysterectomy. Despite the fact that the treatment of many of these patients was inadequate, 10 (12 per cent) were alive at five years and 6 (7 per cent) at ten years.

The group seen between 1914 and 1918 numbered 78 patients. Nine were untreated; 28 were treated by hysterectomy; 11 by hysterectomy and postoperative radium; ten by radium followed by hysterectomy; 23 by radium alone. There was a distinct improvement in the results, with 15 patients (19 per cent) alive at five years and 9 (11 per cent) at ten years.

In the next group of 119 cases seen between 1919 and 1923, 5 were untreated; 18 had hysterectomy; 15 hysterectomy with radium preoperatively or postoperatively; 81 radium therapy alone. At five years, 27 (23 per cent) were alive, and at ten years, 14 (12 per cent) were alive.

In the next period, 1924 to 1928, 226 patients were seen, of whom 7 were untreated; 1 had amputation of the cervix and radium; 24 had hysterectomy; 8 hysterectomy and radium; 186 radium alone. Of this group, 64 (28 per cent) survived five years and 48 (21 per cent) survived ten years. The improved results here are attributed to the use of a single rather massive dose of radium, 200 to 225 mg. being used for twenty-four to thirty hours. However, a total of 6,000 mg. hr. was not exceeded.

Two hundred and seventy-six patients were seen between 1929 and 1933, of whom 5 were untreated; 1 had amputation of the cervix; 2 amputation of the cervix and radiation; 1 hysterectomy; 5 hysterectomy and radiation preoperatively or postoperatively; 109 radium alone, 153 radium and 200-kv. roentgen irradiation. The roentgen radiation was given in four treatments of 400 r each, immediately following the first application of radium. This was repeated in about two months and in some cases a third and sometimes a fourth series was given, six to twelve months later. The results in this group showed 106 (38 per cent) patients alive at five years and 84 (29 per cent) at ten years.

In the last group, 328 cases seen between 1934 and 1938, 12 were untreated; 1 had amputation of the cervix; 1 amputation of the cervix, with radium and x-ray therapy; 5 hysterectomy; 3 hysterectomy and radium; 3 hysterectomy and x-ray; 16 radium, x-ray, and hysterectomy; 32 radium alone; 191 radium and 200-kv. x-ray therapy by the previously outlined method; 41 radium and 200-kv. x-ray therapy with a newer method, and 23 radium and 1,000-kv. x-ray therapy. The results in this group showed 142 (43 per cent) alive at five years. The newer method of 200-kv. roentgen therapy used an average of five treatments through each of three portals, one anterior and two posterior, with an average total dose of 6,000 r measured with scattering. The 1,000-kv. radiation was delivered through three 10 × 10-cm. portals, one anterior and two posterior, for an average total of 7,500 r measured with scattering.

There is a consistent improvement in the five- and ten-year survivals over the years. This is most evident in the number of survivals in early cases. In the more advanced cases, there was some reduction in the number of survivals because of reduction in the amount of roentgen radiation given from fear of complications.

It is interesting to note that over 5 per cent of all the patients had supravaginal hysterectomy prior to the development of cervical cancer and that an additional 3 per cent had had operative procedures on the tubes and ovaries.

The complications encountered as a result of radiation therapy are fully discussed. Proctitis, ileitis, cystitis, rectovaginal and vesicovaginal fistulas, ureteral stricture, ureteritis, and pyelonephritis were the most common complications. The fistulas undoubtedly are the most distressing to the patients, whereas the ureteral strictures are the most serious so far as survival is concerned.

The authors believe that over-treatment in many of their cases accounts for the number of complications that they observed. They now consider anything over 5,400 mg. hr. of radium given in one application or 6,000 mg. hr. in two applications as an over-dose. They feel that the maximum relatively safe amount of 200-kv. roentgen radiation, when combined with the above dose of radium, is 6,000 r (with scattering). The relatively safe dose with 1,000 kv. may be as high as

7,200 r (with scattering). It is their impression that it is best to give all radiation within six weeks and to have the x-ray therapy precede the radium therapy except in cases with hemorrhage, which is more easily controlled by radium. The second most frequent cause for complications is mistaking irradiation reactions for recurrence and giving further treatment. Since retreatment is only occasionally efficacious, and that in questionable cases, it is safer to withhold additional therapy unless evidence of recurrence is convincing.

During irradiation, the authors give vitamin therapy in large doses, including thiamine chloride. Acute post-irradiation pelvic inflammations are best treated by repeated transfusions and bed rest. Rectal strictures are gently dilated, and an attempt is made to maintain soft stools. Instillations of cod-liver oil are used for irradiation cystitis and transfusions and bed rest for severe hematuria. Vesicovaginal fistula has been successfully treated by colpocleisis. Rectovaginal fistula is most satisfactorily handled by colostomy, though this is refused by many patients. Ureteral stricture is often accompanied by cystitis, making it difficult to catheterize the ureters. The procedure of choice, *i.e.* sacrifice of the kidney or reimplantation of the ureter, will depend upon the individual case.

The authors conclude that x-ray and radium therapy are far superior to surgery so far as end-results are concerned, though surgery is required for radioresistant cancers. BERNARD S. KALAYJIAN, M.D.

Radiation Therapy in Uterine Fibroids. John Day Peake. South. M. J. **38:** 480–484, July 1945.

This report is based on a series of 300 patients with uterine fibroids referred for radiation therapy over a period of ten years; 290 were treated. In the majority of cases the predominant symptom was abnormal bleeding. Frequently when this had been controlled by irradiation the tumor showed a considerable decrease in size.

Before instituting radiotherapy, the diagnosis must be assured. Cancer and pregnancy must be ruled out, and one must be sure that there are no pelvic or abdominal complications which will be aggravated by radiation.

Most of the author's patients were over forty years of age, but younger women may be treated by radiation if future childbearing is not a consideration. In several instances in this series irradiation was chosen rather than surgery because of concomitant extra-abdominal disease.

It has frequently been stated that severe menopausal shock follows irradiation. In the author's experience, however, menopausal symptoms are not more severe than after surgery. In several of his younger patients the menstrual cycle was re-established. He encountered no instance of loss of libido, but in no case did pregnancy follow treatment.

The choice of treatment in any given case is governed by many factors. If the diagnosis is unquestioned, and there are no pelvic complications, it is usually safe to use external irradiation alone. If dilatation and curettage are required to rule out other disease, radium within the uterine cavity is preferred. For external irradiation the factors were the conventional ones: 200 kv.p., 20 ma., 50 cm., 6 mm. Al and 0.5 mm. Cu, half-value layer Cu 0.9 mm., 15 cm. port. An anterior and a posterior port were used, except in the presence of large tumors, when a second anterior port was added; 250 to 300 r were given daily to one area, the patient being treated six to twelve times, usually within two weeks. For radium therapy, 35 to 50 mg. were implanted in the uterus with 1.0 mm. platinum filtration. The total dose was 800 to 3,000 mg. hr. When both roentgen rays and radium were employed (in patients who failed to respond to roentgen therapy alone) the radium dose was smaller than in patients previously untreated.

Of the present series, 186 were treated by roentgen irradiation alone, 86 by radium, and 18 by both. In only 2 cases was there failure to relieve the uterine hemorrhage. In one of these a submucous pedunculated fibroid was discovered at subsequent hysterectomy; the other patient had a complicating tubo-ovarian abscess. In 10 cases bleeding recurred after administration of stilbestrol, but ceased when the drug was withheld. In one case theelin caused a return of bleeding. No deaths or complications followed irradiation in this group of 290 cases, and subsequent operation did not appear to be made more difficult.

In the discussion of this paper Dr. R. T. Wilson stated that he had found as much as 3,000 to 4,000 r necessary in the treatment of uterine fibroids. Dr. Edwin C. Ernst emphasized the eminently satisfactory results obtained by fractional roentgen therapy. His observations covered a twenty-five-year experience.

A statistical tabulation of the author's cases would have been a valuable addition to an otherwise excellent paper. MAX MASS, M.D.

Studies in Hodgkin's Syndrome. IV. The Therapeutic Use of Radioactive Phosphorus. Herman A. Hoster and Charles A. Doan. J. Lab. & Clin. Med. **30:** 678–683, August 1945.

The results of radioactive phosphorus therapy in 11 cases of proved Hodgkin's disease are reported. Five of the patients in this series had had previous x-ray therapy. Each biweekly dose of P^{32} was determined as a function of the tolerance of the individual patient, measured in terms of abrupt thrombocytopenia or by other less acute evidences of bone marrow hypoplasia. This treatment was discontinued and other measures substituted in every case when an increase in the activity of the disease was indicated by additional lymphadenopathy or roentgen evidence of bone involvement.

In the majority of the 11 patients, a fall in the hematocrit reading, in the hemoglobin level, and in total red blood cells, platelets, and total white blood cells, including lymphocytes and monocytes, was recorded during radioactive phosphorus therapy. The average bi-weekly intravenous dose was 23.1 millicuries, the minimum 1.26 millicuries, maximum 3.01 millicuries. In 10 of the 11 patients additional adenopathy or demonstrable evidence of bone involvement developed during the course of therapy. The maximum and minimum periods during which treatment was carried out before further activity developed were thirty-seven weeks and ten weeks, respectively. One patient did not return for treatment after the eleventh week, and one patient died during therapy. Eight of the 9 patients who received roentgen irradiation after cessation of phosphorus isotope therapy responded favorably to the former.

The authors conclude that radioactive phosphorus in these cases of Hodgkin's disease in the dosage and under

the conditions described did not prove of therapeutic value. Depression of hemocytopoiesis, with special emphasis on thrombocytopenia, was noticed.

Treatment of Leukemia with Artificial Radio-active Sodium: Preliminary Report. Jørgen E. Thygesen, Aage Videbæk, and Irgens Villaume. Acta radiol. **25:** 305–316, Sept. 20, 1944. (In English.)

The authors investigated the effect of radiosodium (Na^{24}) in 7 cases of chronic lymphatic leukemia and in a case of polycythemia vera. The radioactive isotope of sodium was furnished by Profs. Niels Bohr and J. C. Jacobsen of the University of Copenhagen. Radiosodium is easier to produce than radioactive phosphorus and is distinguished from other usually employed radioactive isotopes in several respects. Unlike radioactive phosphorus (P^{32}), which is a pure beta-ray emitter with a half-life of 14.3 days, radiosodium emits not only beta rays but also very hard gamma rays (even harder than those of radium). Its half-life is only 14.8 hours. While other radioactive isotopes more or less accumulate in certain organs, *e.g.* in bones or lymphatic tissue, radiosodium is found almost exclusively in the extra- and intra-cellular fluid. Unlike radiophosphorus, it maintains an almost constant level in the blood stream. Its distribution and radiation are much more diffuse in the body than those of other radioactive substances. Excretion is slow and takes place through the urine.

The single doses in the cases treated varied from 2 to 36 millicuries, injected intravenously in 20 c.c. of physiologic NaCl solution. The total dose ranged from 6 to 178 millicuries, given in 1 to 12 injections with a usual interval of about 48 hours. In two cases (not tabulated in the article) radioactive sodium chloride was administered orally in milk or soda water.

Untoward symptoms were rare and mild; they were represented by slight diarrhea, hot flashes, slight fever, and, in one case of oral administration, by nausea and vomiting. Except in one case which later also proved resistant to x-ray radiation, the injections were followed by a considerable fall in the leukocyte count (in one case from 95,000 to 21,000 within four days). There was no significant change in the erythrocyte count, the hemoglobin percentage, or the sedimentation rate. The general condition of the patients improved during the treatment both subjectively and objectively. The relatively short period of observation (maximum about 150 days) and the limited number of cases preclude definite judgment as to the final value of the treatment, although the apparently favorable results encourage further trials. In the case of polycythemia vera, the effects were inconclusive and transitory.

ERNST A. SCHMIDT, M.D.

DOSAGE

Dosis Measurements in Roentgen Irradiation of Female Pelvis: Preliminary Communications. Anton Jensen. Acta radiol. **26:** 99–116, Jan. 22, 1945. (In English.)

The author made phantom studies of depth dose in the female pelvis both with standard technic and rotation technic. He found that an eccentric, rotating pair of fields which make an arc of 104° from above laterally on each side gives the optimum depth dose.

LEWIS G. JACOBS, M.D.

Determination of the Dose in Circular Phantoms under Rotatory Irradiation. Howard Nielsen. Acta radiol. **25:** 183–194, June 30, 1944. (In English.)

The author's studies cover the amount of the surface dose and the dose in the center of the rotation—the axis dose, or center dose—at a given output with rotatory irradiation and circular phantoms. Also, the dependence of these values on the diameter of the phantom, size of the field, radiation quality, and divergence of rays (target-center distance) are studied.

The results were recorded graphically in three curves for each phantom. These curves give (1) the dose measured on the surface, recorded in percentage of output, (2) the dose measured in the center, converted to percentage of the output, and (3) the proportion between the center dose and the surface dose. The term efficiency coefficient (EC) was adopted for the ratio between the center dose and the surface dose.

The curves show that, using rotatory irradiation, the most favorable conditions are obtained with a narrow axis field, medium-sized phantom radius, hard rays, and great target-center distance. In practice, the radius (cross section of the body) is given and the axis field determined by the extension of the tumor, so that changes in the conditions are limited to the target-center distance and the radiation quality.

Dose distribution curves for different axis fields are given. The values measured for the dose in the center are considerably higher than calculated, and the difference between the measured and calculated dose distribution curve is mentioned. Because of such differences, the author advises care in the use of rotatory irradiation, as the risk of over-dosage is far greater than in ordinary roentgen treatment.

JOSEPH H. WEISS, M.D.

A Simple Device for the Continuous Control of Roentgen-Ray Output. Sv. Hoeffer Jensen. Acta radiol. **25:** 224–226, June 30, 1944. (In English.)

An essential feature of roentgen therapy is the constancy of output of the roentgen tube. Such constancy is generally assured by measurements of intensity made from time to time, and it is then assumed that if consecutive measurements do not differ from each other, the output has been the same during the intermediate period.

Intensity may vary sufficiently to be of clinical importance according to the author. He has designed an instrument to measure the total flux of roentgen rays. It consists of two parts: (1) ionization chamber and (2) amplifier.

Diagrams are given illustrating the installation of the ionization chamber on the tube and the amplifier circuit. This apparatus makes possible simple and continuous control of the roentgen output.

JOSEPH H. WEISS, M.D.

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